Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices

see revision 1965

Revised 1956
On shelf

UNITED STATES DEPARTMENT OF AGRICULTURE
MISCELLANEOUS PUBLICATION No. 310

Washington, D. C. Issued May 1938

THE CLASSIFICATION OF COTTON

Prepared by the
BUREAU OF AGRICULTURAL ECONOMICS

UNITED STATES
DEPARTMENT OF AGRICULTURE
MISCELLANEOUS PUBLICATION NO. 310

Washington, D. C. Issued May 1938

THE CLASSIFICATION OF COTTON

Prepared by the Bureau of Agricultural Economics [1]

CONTENTS

Item No. Page
A. Nature of cotton and basis of its classification 3
1 The cotton fiber 3
2 Botanical classification of cotton 3
3 Causes of variation in quality 3
Why cotton is classed 5
5 Quality elements the basis for classification 5
6 Classification of cotton 5

B. Sampling and the care and handling of samples 8
7 General practices 8

C. Factors of grade 10
8 Grade embraces three factors 10
9–12 Color 11
13–15 Foreign matter 13
16–19 Preparation 15

D. Standards for grade 15
20 Number of standards 15
21 Universal standards for the grade of upland cotton 17
22 Copies of standards put up in boxes 17
23 Standards for six major color groups 17
24 Grade names 20
25 Foreign matter and preparation in physical standards for grades of colored cotton are equal to that in boxes of White 20
26 Descriptive grades 20
27 Tentative standards for preparation 20
28 Grade not specified without reference to all three grade factors 22
29 American-Egyptian grade standards 22
30 American-Egyptian and upland grade factors differ 22
31 Permissive status of some standards 22
32 Year's notice before change in standards 22

E. The determination of grade 22
33 General considerations 22
34 Importance of lighting conditions 24
35 Directions for handling samples in grading 24
36 Regulations 24
37 Samples differing in successive "breaks" 26
38 How to compare samples with standards 26
39 Classing on descriptive standards 26
40 Value class should be that of nearest grade standard, not grade of equivalent value 26
41 Grading against individual samples in standards box 28
42 Averaging factors of grade 28
43 Split designations 28

F. Method of grading irregular and special-condition cotton 28
44 Classification of special conditions 28
45 Snapped and sledded cotton 29
46 Bolly cotton 29
47 Gin-cut cotton 29
48 Reginned cotton 29
49 Repacked cotton 29
50 False-packed cotton 29
51 Mixed-packed cotton 30
52 Water-packed cotton 30
53 Other special conditions 30
54 Dusty and sandy cottons 30
55 Oil-stained cotton 30
56 Seedy cotton 30

---

[1] In this handbook, for the convenience of workers, each item has been given a number and each unit of discussion has been given a letter.

The activity discussed is (1946) a part of the work of the Production and Marketing Administration, which is reissuing this publication.

Item No. Page
G. Inaccuracies in grading cotton 30
57 Common errors in grading 30
58 Sources of variations in grading 31
59 Types of variation—causes and remedies 31
60 Bias resulting in hard or easy classification 31
61 Prior experience or knowledge of previous classification an influence 31
62 Erratic classification 31
63 Failure to use certain grades 32
64 Tendency to group the samples toward Middling 32
65 Nonrecognition of grade factors 32
66 Insufficient care 32
67 Inadequate samples 32
68 Lack of good light 32
69 Errors can be reduced 32
70 Thorough knowledge of standards necessary 32

H. Factors of staple and the standards for staple 33
71 Staple length defined officially 33
72 Staple length an important quality factor 33
73 Lengths of fibers in a sample 33
74 Fibers rejected in classer's pull 33
75 Promulgation of official standards for staple 33
76 Original promulgation order amended 35
77 Types match original representations 35
78 Staple types represent normal character 35

I. Method of stapling 35
79 Regulations concerning stapling 35
80 Typical portion selected by stapling 38
81 Instructions for pulling staple 38
82 The break in pulling staple 39
83 Special conditions in stapling 39
84 Perished staple 39
85 Immature cotton 39

J. Common errors in stapling 39
86 Lack of familiarity with standards an outstanding cause of error 39
87 Tendency to omit certain lengths 40
88 Tendency to class all staples toward familiar lengths 40
89 Judging on the break 41
90 Other causes of error 41

K. Factors of character 42
91 General definition of character 42
92 Purpose of character appraisal 42
93 Character not officially standardized 42
94 Laboratory methods for measuring some character factors 42
95 Uniformity of length 42
96 Strength of fiber 43
97 Strength as determined by the classer 43
98 Fineness and maturity of fibers 44

L. Effect of moisture on staple and character 44
99 Physical properties affected by moisture content 44
100 Pliability 44
101 Elasticity 46
102 Strength 46
103 Frictional properties 46

M. Relation of classification to prices 46
104 Classification and price 46
105 Futures contracts 46
106 Grade differences 47
107 Staple premiums and discounts 47
Literature cited 48
Appendix 48
Official cotton standards of the United States in effect May 1938 48
Public notice establishing official cotton standards of the United States for the grade of American upland cotton, effective August 20, 1936 49
Public notice establishing standards for length of staple 53
Promulgation of grade standards for American-Egyptian cotton and of tentative preparation standards for long-staple cotton 54

A. NATURE OF COTTON AND BASIS OF ITS CLASSIFICATION

1. **The cotton fiber.**—Raw cotton, in its usual marketable form, consists of masses of fibers packaged, for convenience of handling, in bales. In a single pound of lint cotton there may be 100 million or more individual fibers. The individual fiber is the unit upon which the spinning quality of cotton depends. Although it is primarily the quality of cotton fibers in mass and not of individual fibers with which the cotton classer deals, it is well to keep in mind the fundamental fact that the quality of cotton in its mass form is necessarily dependent upon the properties of the individual fibers of which the mass is composed and upon the proportions in which fibers having different properties are mixed.

Each fiber is a single cell that develops in the surface layer of cells of the cottonseed. During the early stages of its growth, the fiber consists of a central strand of living matter surrounded by a fiber wall. The process of wall thickening, in which a material consisting largely of cellulose is deposited, takes place during the second half of the period of fiber growth. When the growth period is over, the living material dies and shrinks. The fiber then consists of a tubular wall and a central canal. When the bolls open, these fibers, which vary considerably in length and degree of wall thickening, collapse much as does the deflated inner tube of an automobile tire; and in collapsing, they become twisted about their own axes, forming what are known as convolutions (fig. 1).

2. **Botanical classification of cotton.**—Botanically, there are three principal groups of cotton *(1, pp. 327–328)* [2] that are of commercial importance. Those that have been developed in the United States from cotton native to Mexico and Central America (*Gossypium hirsutum*) are known as upland cottons and vary in staple length from about ¾ to 1½ inches. A second botanical group which is of early South American origin (*G. barbadense*) is generally of longer staple and includes Egyptian, American-Egyptian, and sea-island cottons and some of the Peruvian and Brazilian varieties. A third group embraces those shorter-stapled cottons that are native to India and eastern Asia (*G. herbaceum*).

Upland cottons comprise all of the annual American crop with the exception of a few thousand bales of American-Egyptian cotton and a small quantity of sea island. Long-staple upland cottons, which are usually defined as upland cottons having a staple length of 1⅛ inches or more, are grown in the Delta areas of Mississippi, Arkansas, and Louisiana; and in California, New Mexico, and South Carolina. Some scattered production of minor importance occurs in most of the other cotton-growing States. American-Egyptian (Pima) cotton is grown mainly in Arizona, and sea-island cotton is grown in small commercial quantities in Georgia and Florida. Other areas throughout the Cotton Belt grow, for the most part, shorter stapled upland varieties.

3. **Causes of variation in quality.**—About 2 million farms in this country produce cotton, and in any single year great variation is found in the quality of this production. Variation occurs even in the

---

[2] Italic numbers in parentheses refer to Literature Cited, p. 48.

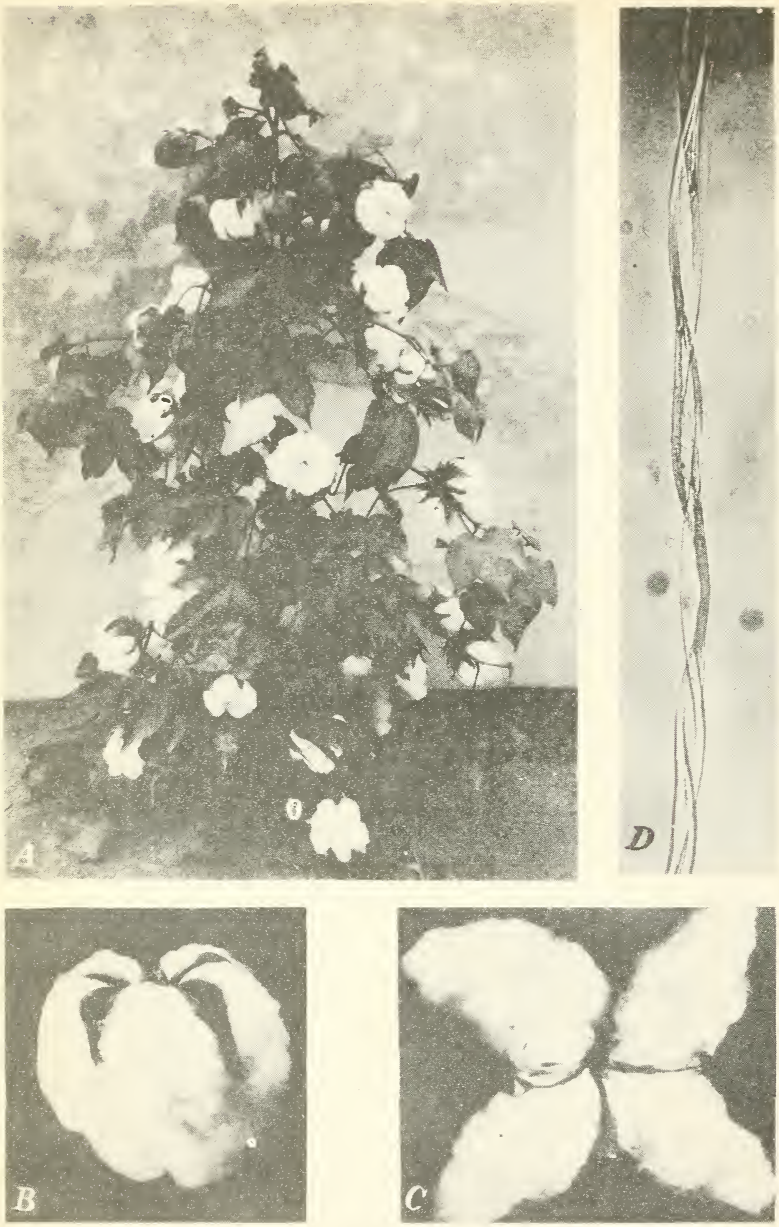


FIGURE 1.—Cotton: *A*, On the plant; *B*, in the boll; *C*, the several locks in the boll; *D*, single fiber, showing wall thickness and convolutions, magnified.

quality of cotton grown on a single farm. Soils, rainfall, temperature, varieties planted, tillage methods, and harvesting and ginning methods vary. To such variations may be attributed the many differences in the quality of the cotton crop as it comes to market.

4. **Why cotton is classed.**—In the manufacture of cotton, uniformity of quality in the raw material is essential and since manufacturers must have cotton that is more or less uniform in respect to grade, staple length, and character, it is necessary to accumulate bales of diverse qualities that are produced on numerous farms and plantations, and from this accumulation to select bales of cotton that will fall into lots that are uniform or nearly uniform (even-running) in quality. Classification as to quality is therefore an essential service both to marketing and to manufacturing. Table 1 gives a description of American cotton bales, which are illustrated in figure 2.

TABLE 1.—*Description of American cotton bales* [1]

Kind of bale [2]	Dimensions (approximate)	Weight (approximate)		Ties, per bale	
		Per bale	Per cubic foot	Usual	weight
	Inches	*Pounds*	*Pounds*	*Number*	*Pounds*
Flat, gin, or uncompressed	54 x 27 x 45–48	500	12–15	6	9
Standard density	56 x 28 x 18–22	500	22–28	8	9
High density	59 x 24 x 19	500	28–40	9	9
Round bale	35 length, 22 diameter	250	33	0	0
Ginner's compress bale	52 x 25 x 20	500	25–35	6	(3)

[1] Approximately 6 yards of bagging, generally 1¾ or 2 pounds per linear yard, are used to cover all but the round bale. After sampling, 1 to 2 patches which usually weigh 2 to 4 pounds each are generally added. Tare, which includes bagging, patches, and ties, is allowed, by southern mill rules, up to 22 pounds for the flat bale (500 pounds) and 24 pounds for the compressed bale. Under the New England rules up to 24 pounds is permissible for the compressed bale, but no separate provision is made with respect to tare for the flat or gin bale. For further tare information see the following: WRIGHT, J. W., U. S. Dept. Agr. AMERICAN COTTON TARE PRACTICES AND PROBLEMS. Multigraphed Report. April 1933.

[2] The proportion of bales received in 1930–31 by domestic mills was: 37 percent of gin bales (all in cotton-producing States), 57 percent of standard density, less than 6 percent of high density, and ½ percent of round. Ginner's compress bales are not produced in commercial quantities.

[3] Weights vary.

5. **Quality elements the basis for classification.**—As used in this publication, the quality of cotton is defined as the physical properties, characteristics, or attributes of cotton which affect its usefulness. The principal physical properties and characteristics of cotton which affect its quality are color, leaf and other foreign matter, ginning preparation, length of staple, uniformity or evenness of length, fineness, strength, and maturity. In general, the more desirable a cotton is from the standpoint of the use that can be made of it, the higher its quality is said to be; and the less useful a cotton is, the lower is its quality. Classification of cotton is built upon the principle of relative usefulness.

6. **Classification of cotton.**—Cotton classification or classing, for purposes of marketing and utilization, is the art and operation of systematically recognizing and identifying similarity in quality according to accepted scales of measurement, by a consistent method, and by the use of consistent terms of description. Against fixed scales of quality graduation (standards), comparisons are made by the senses of sight and touch. For grade, the sense of sight is principally used; for staple and character, sight and touch are used in combination.

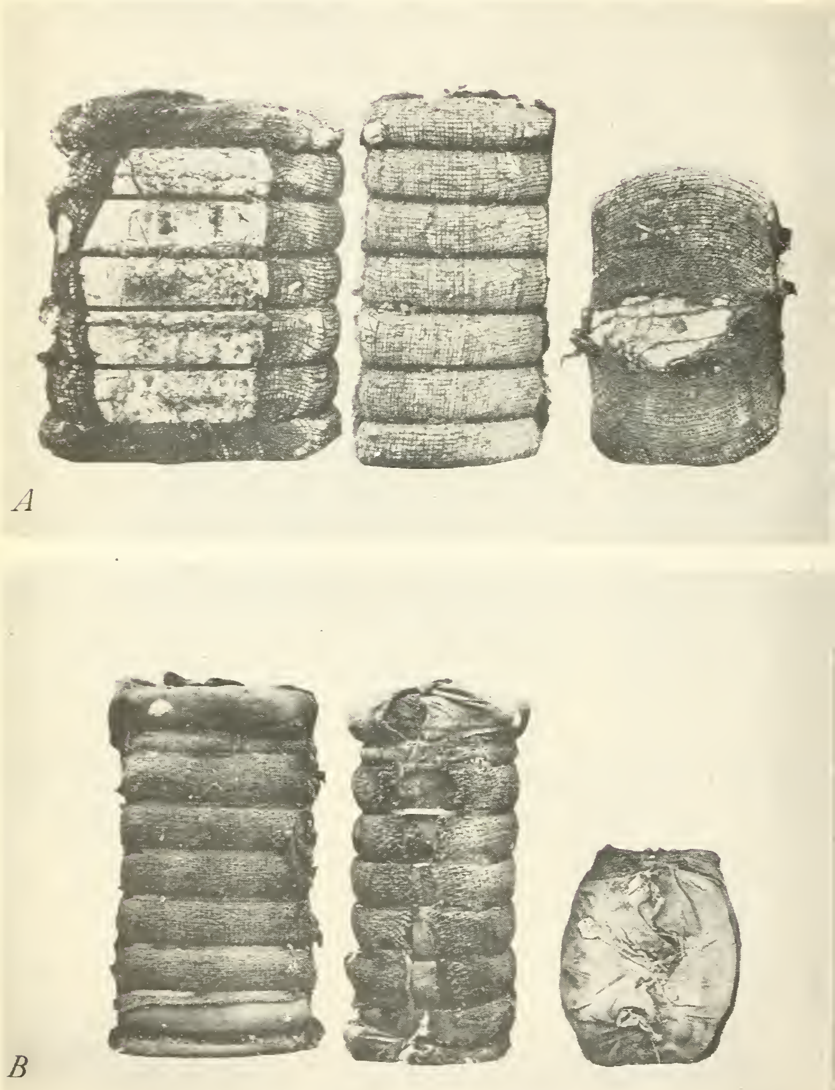


FIGURE 2.—*A*, Ginner's, or flat bale; *B*, standard-density bale.

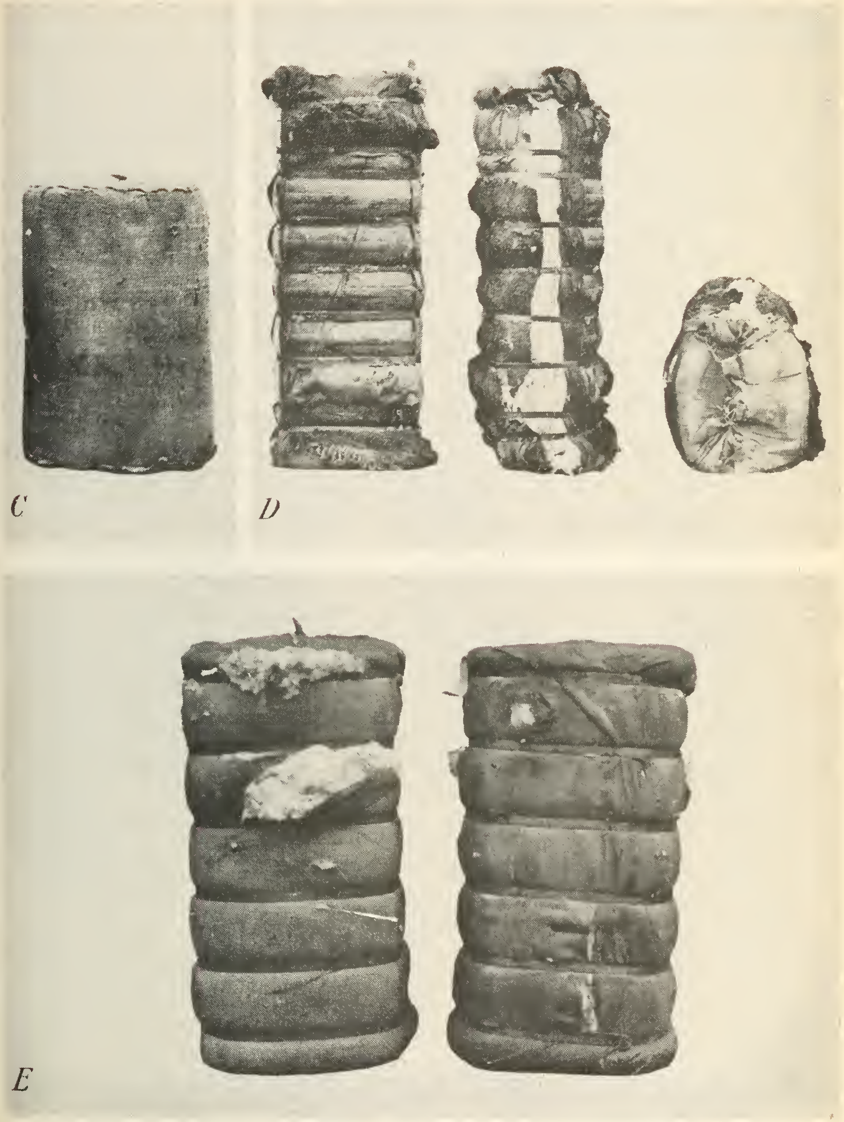


Figure 2.—*Continued.*—*C*, round bale; *D*, high-density bale; *E*, ginner's compress bale.

B. SAMPLING AND THE CARE AND HANDLING OF SAMPLES

7. **General practices.**—Because of the size of the cotton bale, it is inconvenient and impracticable for a buyer to inspect actual bales at the time of purchase. Therefore, it is general practice for transactions to be made on the basis of samples drawn from each bale. If the samples are to be useful, they must be representative of the bales from which they are taken. A sample usually consists of two parts taken from the two sides of the bale, and weighs about 6 ounces. In drawing the sample, the bale should be cut sufficiently deep to reveal mixed packs and plates, if they exist, and the face of the sample should be from 4 to 6 inches wide. A sample should never be drawn by cutting a second time into an old sample hole, for samples obtained in this way usually have narrow faces. If the sample is improperly drawn, if it is too small, or if the face is too narrow, it is difficult to determine its correct classification.

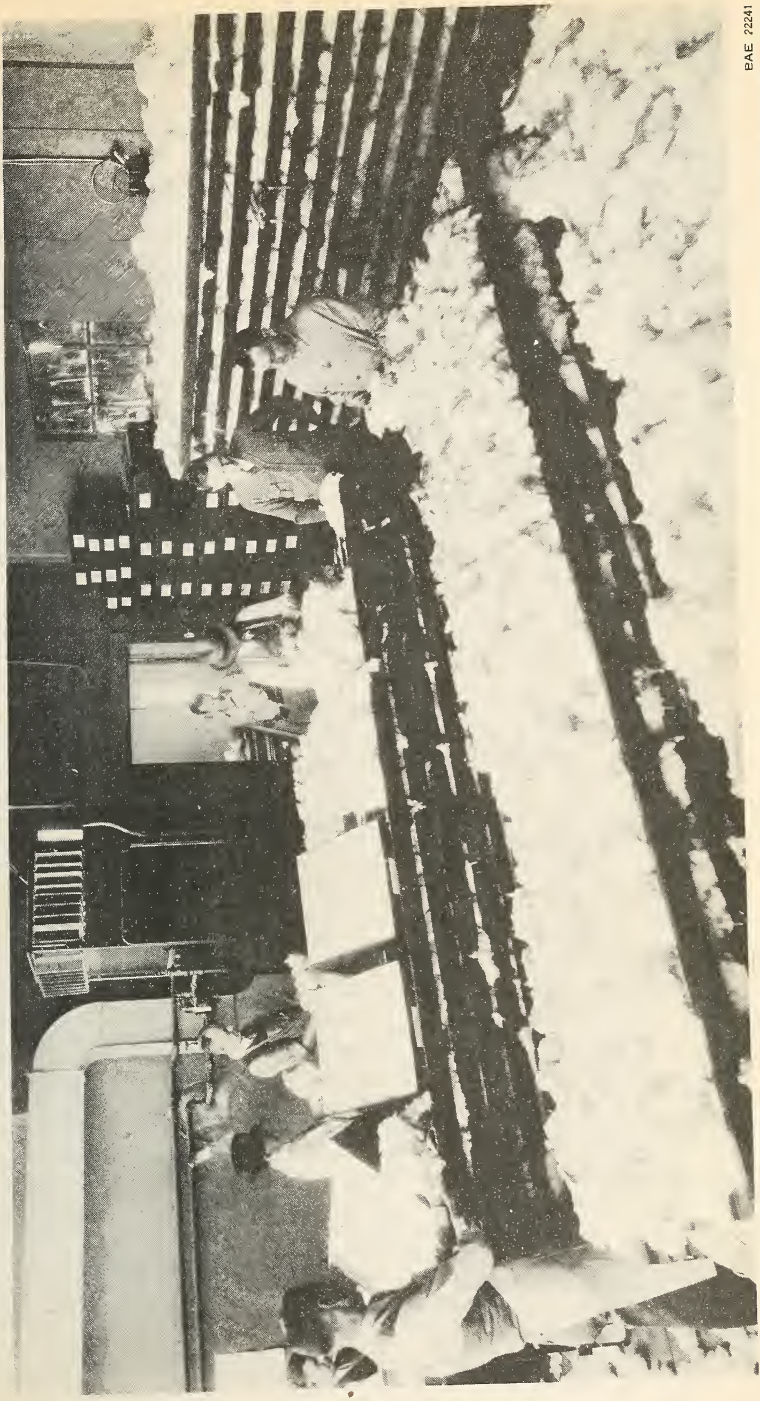
After a sample has been properly drawn, it should be handled carefully to preserve its representativeness. In trimming or dressing a sample, only bagging-stained or otherwise damaged cotton on the outer surface should be removed. In handling samples, it is important to see that no particles of leaf, dust, or sand are dropped upon them, since they may be changed in grade by the accidental accumulation of such foreign matter.

The usefulness of a sample depends upon the preservation of its identity. The tag coupon showing bale number, compress, etc., should be kept in the center of the sample, between the portions from the two sides of the bale. Otherwise it may be difficult to detect mixed bales, particularly those of mixed staple (fig. 3).

Samples from round bales are drawn with an auger, and must therefore be dressed before classification is attempted. When they are properly dressed and conditioned, classification may be made by direct comparison.

A sample obtained from the press box of a gin, before any pressure has been applied, differs in appearance from cut samples. The foreign matter is less prominent, the preparation is slightly rougher, and the brightness in the higher grades, because of shadow, does not appear so high as in a sample drawn from a standard-density bale. In classing samples obtained from the press box, adjustment is made for such differences. When not properly conditioned, the staple of samples from the press box, although actually no shorter, will appear somewhat shorter than that from a standard bale, a factor which is taken into consideration when the samples are stapled in comparison with the official staple types.

According to regulations governing the classification of cotton under both the United States Cotton Futures Act (*7*) and the United States Cotton Standards Act (*8*), two requirements are to be observed in the handling of samples for classification: (1) Classification must not proceed until the samples have been exposed for such a length of time as shall be sufficient to put them in proper condition for classification, and (2) classification shall not proceed when light or other conditions make uncertain the accuracy of the results to be obtained.



BAE 22241

FIGURE 3.—Samples laid out on classing tables. Tags are placed in the center of each sample, separating portions of the sample drawn from opposite sides of the bale.

Samples should be laid upon the classing table and left for a brief period before they are classed, to allow them to loosen and to permit their moisture content to come to equilibrium with that of the atmosphere in the classing room so that the classer may class them without having to make allowance for excess moisture or for excessive dryness. For freshly drawn samples, a few hours are ordinarily considered sufficient for this purpose unless the samples have been received in a wet or damp condition, or are excessively dry, in which cases they should remain exposed until they are in proper condition for classing. Conditioning of samples from high-density bales is particularly necessary since in freshly drawn samples from such bales the leaf and foreign matter appear more prominently than in others, and the fibers seem to have greater "cling" or "drag" in stapling than is the case with samples from flat or standard-density bales.

After a sample has been classed, if it may be needed for future reference it should be carefully wrapped or rolled, care being taken not to mix cotton from opposite sides of the bale. It then should be fully marked for identification purposes and stored until there is no further need to refer to it. Such samples should not be allowed to remain on tables after classing, as the exposure is likely to cause color changes such as the fading of spots and tinges, and loss of brightness as a result of the accumulation of dust.

The useful life of a sample will depend to some extent upon its size, the care given it, and the frequency with which it is handled. After a sample has been classed more than three times, its representativeness is ordinarily subject to question.

The storing of samples in heated rooms should be avoided, because excessive drying is likely to result. The storing of samples in very damp places is also objectionable, as dampness may cause the formation of yellow spots.

Martin and Cleaves [3] discuss in considerable detail the prevailing practices in the sampling of cotton and factors affecting the representativeness of samples.

C. FACTORS OF GRADE

8. **Grade embraces three factors.**—Grade of cotton, as the term is most widely understood, is composed of three factors—color, foreign matter, and ginning preparation. Grade gives, by means of variation in the *color* factor, certain information concerning the weathering, or exposure to which the open cotton has been subjected and, in some instances, information concerning attacks by insects, fungi, and the like, both before and after the boll is opened. By means of variation in *foreign matter* grade gives information concerning the methods of harvesting, and something concerning the effects of weather conditions before and during picking. Because of variations in *preparation*, grade gives information concerning storage or handling conditions previous to ginning, and the care and efficiency of ginning. It is evident, therefore, that grade refers principally to noncotton elements, particularly to effects produced upon cotton fiber after the boll has opened in the field.

---

[3] MARTIN, SAM W., and CLEAVES, FLORENA. SAMPLING AMERICAN COTTON . . . U. S. Bur. Agr. Econ. 37 pp., illus. 1936. [Mimeographed.]

COLOR

9. **Color attributes.**—Color may be described in terms of three attributes—hue, brilliance, and chroma. Hue may be most simply defined as the *name* of a color, as for example, yellow, red, blue; brilliance as the *lightness or darkness* of a color; and chroma as the *intensity,* strength, or degree of color (*2*). In its application to the color of cotton the term "chroma" refers to the degree of yellowness. The darker gray cottons possess little chroma, the yellow stained a great deal more. Differences in brilliance and chroma are the only important color differences in cotton classification since hue varies little in upland cotton.

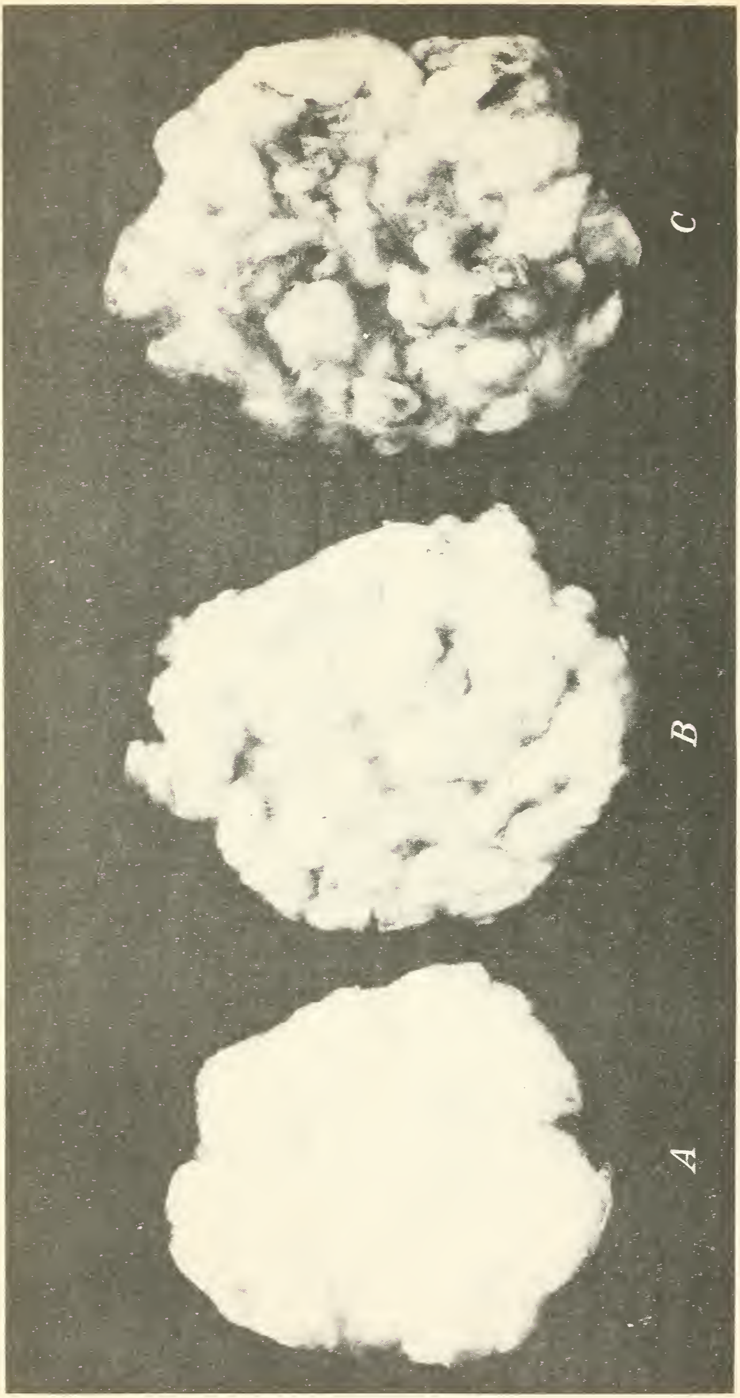
10. **Color terms have meanings peculiar to cotton trade.**—The terms "yellow" and "blue," which normally indicate two very different hues, are often used in the cotton trade to imply a difference in chroma rather than in hue. The cotton man calls "blue" those cottons which the layman would call dark gray. This is done in an attempt to differentiate such cottons from the more yellow stained cottons which contain so much more chroma. Blue has a technical meaning peculiar to the cotton trade, and does not indicate a true hue difference as the layman sees it. Any cotton officially described as blue stained is not deliverable on futures contracts, but the present standards for grade do not include any grades for blue stained. White also has a meaning peculiar to the cotton trade, for it covers a wide range of colors, from the creamy yellow of the higher grades, to the dull gray and yellowish bales of the low grades.

11. **Color variations in cotton.**—In the grading of upland cotton both major and minor color differences are recognized. The major color differences are those between the classes of Extra White, White, Spotted, Tinged, Yellow Stained, and Gray, the differences being chiefly those of chroma. The Gray and Extra White bales contain little chroma as compared with that which is caused by increasing degrees of yellowness in the White, Tinged, and Yellow Stained bales. The minor differences are those which occur between grades of any single color class, as between White Middling and White Strict Low Middling, or within single grades, as the difference between the brightest and dullest samples of White Strict Low Middling. These minor differences are chiefly of brilliance, the higher grades being brighter than the lower grades, yet they contain also some chroma differences as is shown between the gray and the creamy or spotted samples within certain grades.

12. **Effect of weather on color.**—In the early part of the season cotton is generally of high grade, that is to say, it is bright in color and does not carry a great amount of leaf. Cotton from bolls that open after frost may be tinged or stained a yellow color. When such bolls are picked and are ginned with other bolls that have opened normally before frost, spotted cotton results. Spots are also caused by insect injury and in localities of red soil by the inclusion of bolls that have fallen to the ground and become land stained. Open cotton that is left in the field exposed to the weather becomes darker and dull in color[4] and therefore lower in grade (fig. 4). When cotton from tinged or stained bolls is mixed with that from bolls that have been dulled by exposure, the resulting mixture has a mottled color.

---

[4] NICKERSON, DOROTHY. GRADE OF COTTON AFFECTED BY EXPOSURE IN THE FIELD. U. S. Bur. Agr. Econ. 12 pp., illus. 1933. [Mimeographed.]



BAE 23817

FIGURE 4.—Differences in color of cotton picked from the same field; *A*, Early; *B*, midseason; *C*, late. The cotton was ready to pick in September. The samples shown were picked during that month, mid-December, and early in March.

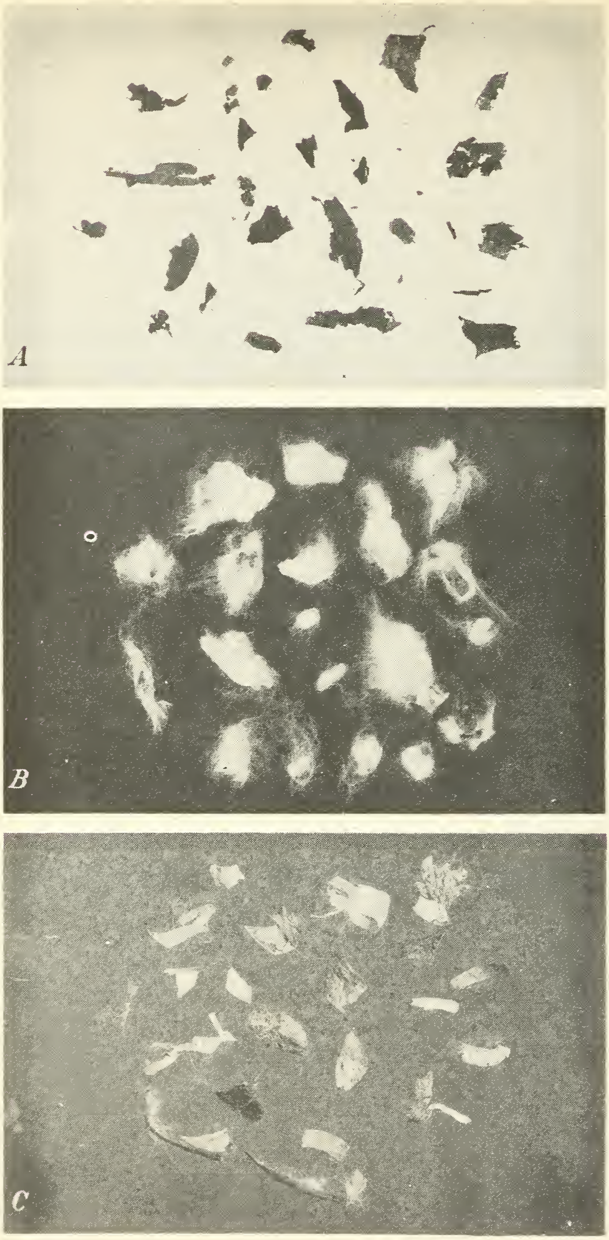
FOREIGN MATTER

13. **Nature of foreign matter.**—Foreign matter includes dried and broken plant foliage of various kinds, motes, seed-coat fragments, and sometimes sand and dust. Leaf may be divided into two general groups, (1) large leaf and (2) "pin" or "pepper" leaf. Large leaf is generally less objectionable than pin or pepper leaf, since larger particles are more easily removed in the spinning process and are less likely to appear in the yarn. Many of the leaf particles are removed in the picker room of the mill, and most of those that remain are removed by the carding process. Stems and hulls, like large leaf, are easily separated from the lint and in the manufacturing process never get further than the cards; but shale, the silverlike lining of the carpel or burr which before the opening of the boll serves to separate the locks, is highly objectionable and difficult to remove from the lint. Motes, which are immature and undeveloped seeds, are also objectionable. They vary considerably in size. Some are exceedingly small but others are nearly as large as mature seeds. These motes sometimes have a number of long fibers attached that usually are thin-walled. Some of the motes are crushed during ginning, and the fragments of various sizes that result are scattered through the lint (fig. 5).

Fragments of mature seed coats are also found in the lint. These fragments result mainly from two causes: (1) The cutting of the seed by the teeth of the gin saw, and (2) the pulling away of the blunt end of the seed during ginning. The pulling away of this large fragment is usually accompanied by separation from it of smaller particles of seed coat with their attached fibers. These smaller particles may be very neplike in appearance (item 18). There also occur in very small numbers other neplike structures such as (1) knots formed by fibers becoming entangled around bits of foreign matter or small particles of seed coat, (2) small fragments from the brittle, glistening, compressed sheets of fibers occasionally found on seeds or motes, and (3) small yellowish fragments from dried diseased areas which frequently occur on the seeds.

If sand and dust are found in quantities exceeding a trace, they constitute what is known as a special condition. Sand in a sample may be detected by shaking the sample gently over a piece of clean paper. Dust is not so easily detected. Its presence is indicated by a dull, unnatural color in the cotton and can be detected by manipulating the sample somewhat as a bellows, that is, by clasping it between the hands which are then pulled gently away from each other, but not enough to separate the sample, and then pushed together, thus forcing air through the sample. As the air is forced out it carries with it some of the dust, which is visible in the surrounding air.

14. **Graduation in quantities of foreign matter.**—Foreign matter varies in quantity through each of the grades, increasing by progressively lengthening steps from the high grades, in which there is little leaf, to the lower grades, in which the proportion is comparatively large. The proportion of waste varies inversely with that of the spinnable lint, and therefore the grades with the highest spinning qualities, other conditions being equal, are those in which there is the least proportion of leaf and other foreign matter.



A—BAE 33024; B—33025; C—33026

FIGURE 5.—Foreign matter: *A*, Leaf; *B*, motes; *C*, shale.

15. **Percentage of waste in different grades.**—The relative quantities of the different types of waste vary considerably, particularly in the low grades. For general information, however, the average and the range of waste percentages found at the spinning laboratories of the United States Department of Agriculture are given in table 2.

TABLE 2.—*Summary of total visible picker and card waste* [1] *for the different grades of cotton tested at the spinning laboratory of the United States Department of Agriculture, Clemson, S. C.*

Grade	Tests	Percentage of waste			Grade	Tests	Percentage of waste		
		Mean	Highest	Lowest			Mean	Highest	Lowest
	Number	*Percent*	*Percent*	*Percent*		*Number*	*Percent*	*Percent*	*Percent*
SGM	4	6.12	7.17	5.38	SLM	32	9.80	16.53	7.12
GM	76	6.83	9.24	5.08	LM	24	10.97	16.22	8.23
SM	109	7.46	10.80	5.65	SGO	9	12.82	15.00	10.27
M	73	7.85	10.98	5.10	GO	10	15.16	18.09	12.99

---

[1] In this compilation, cottons classed as Extra White, Spotted, and Tinged, have been included with the corresponding white grades.

PREPARATION

16. **What is preparation?**—Preparation is a term used to describe the degree of smoothness with which the lint is ginned, and the relative nappiness or neppiness of the ginned lint.

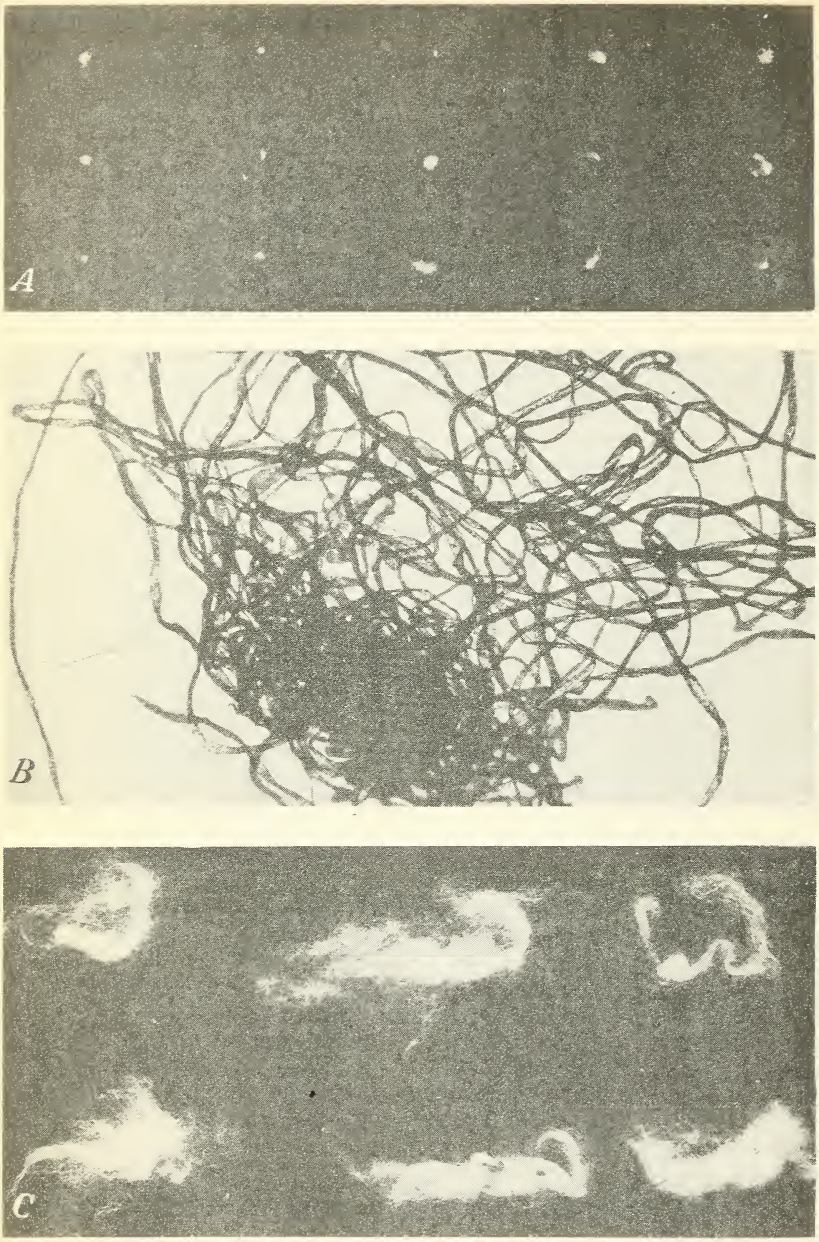
17. **Effect of preparation on spinning utility.**—The spinning utility of cotton depends to some extent upon its preparation. Generally, smoothly prepared cotton contains less waste and produces a smoother and more uniform yarn than roughly prepared cotton. It is generally difficult, however, to gin long-staple cottons so that the ginned lint will have as smooth and even an appearance as the shorter staples.

18. **Neps.**—Neps, in contrast to naps (item 19), are the small tangled knots of fibers (fig. 6, *A*) that are visible as dots or specks when a thin web of fibers is held to the light or against a dark background (*3*). Neps in lint are very undesirable for, if not removed, they will appear as knots in the yarn and fabrics. The removal of neps from the lint is difficult, costly, and frequently impossible to accomplish. The longer and therefore finer cottons tend to be more "neppy" than the shorter, coarser cottons. Lints possessing a high percentage of thin-walled immature fibers are especially likely to be neppy.

19. **Naps.**—The term "nappy" describes a lint that is rough and lumpy, and the term "nap" is applied to the definitely large clumps or matted masses of fibers that contribute to the rough appearance of ginned cotton (fig. 6, *C*). Their formation is influenced to a large extent by the condition of the seed cotton at the time of ginning, for cotton that is ginned green or wet tends to be nappy. In ginning, a very tight seed roll tends to result in the production of nappy lint.

D. STANDARDS FOR GRADE

20. **Number of standards.**—The official standards for grade embrace (May 1938) 32 grades for upland cotton and 5 full grades and 4 half grades for American-Egyptian. In addition there are tentative standards representing three degrees of preparation of upland cotton 1⅛ inches and greater in staple length, of the grades Strict Middling, Middling, and Strict Low Middling (pp. 20, 49).



BAE 33331

FIGURE 6.—*A*, Neps, small tangled knots of fibers that are visible as dots or specks in the lint, natural size; *B*, a nep seen under the microscope showing tangles of fibers, × about 70; *C*, naps, large and matted clumps of fibers, which contribute to the rough appearance of lint cotton, natural size.

21. **Universal standards for the grade of upland cotton.**—The 32 grades for upland cotton now in effect were promulgated by the Secretary of Agriculture on August 20, 1935, effective August 20, 1936, under the United States Cotton Futures Act (U. S. Code, title 26, secs. 1090–1106) and the United States Cotton Standards Act (U. S. Code, title 7, secs. 51–65). In the order of promulgation it was provided that—

> Since these standards have been agreed upon and adopted by the leading European cotton associations and exchanges, they may be * * * termed and referred to as Universal Standards for American Upland Cotton (p. 50).

Thirteen of these grades, namely, those for White cotton of the grades Strict Good Middling to Good Ordinary and those for Tinged cotton of the grades Good Middling to Low Middling, are represented in physical form by standard boxes and the other 19 are descriptive (table 3). The 5 full grades for American-Egyptian cotton are represented by standard boxes and the 4 half grades are descriptive.

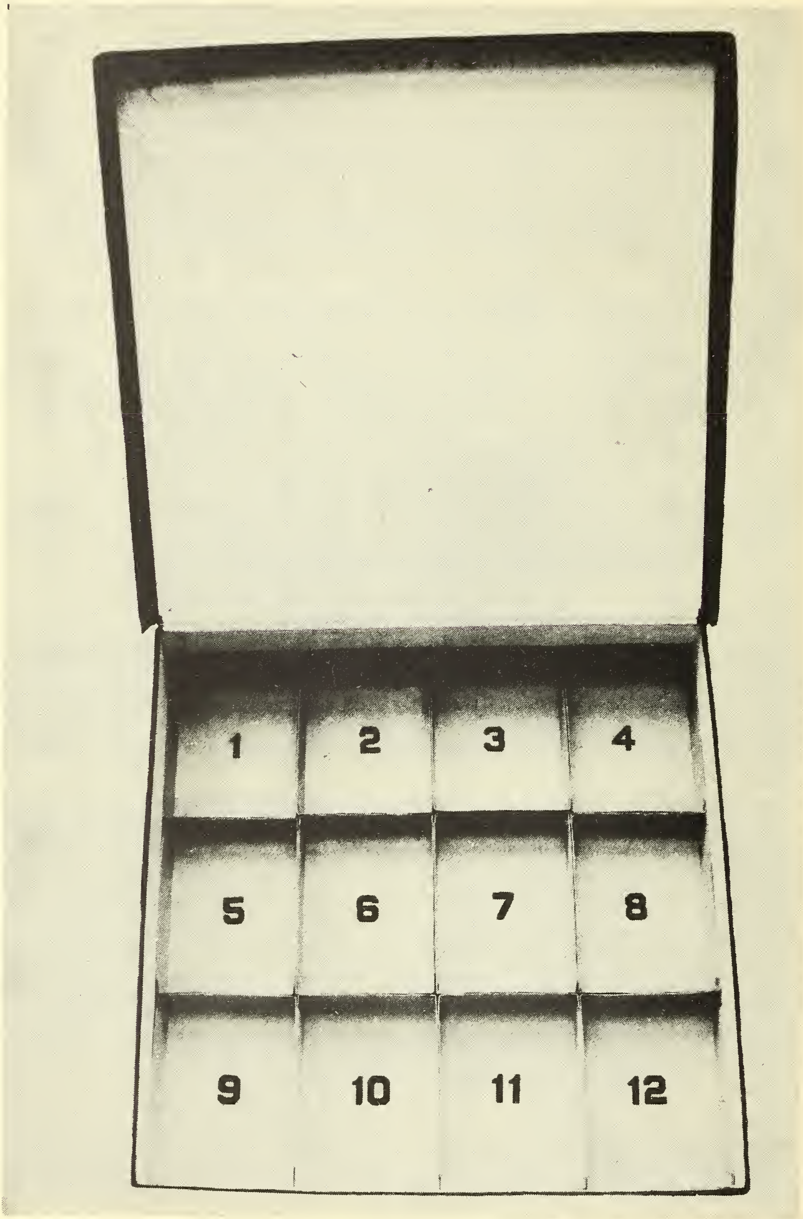
TABLE 3.—*Official standards for grade of American upland cotton* [1]

Gray	Extra White	White	Spotted	Tinged	Yellow Stained
		No. 1, or Middling Fair			
		No. 2, or Strict Good Middling			
GMG	GMEW	**No. 3, or Good Middling**	GMSp.	**GMT**	GMYS
SMG	SMEW	**No. 4, or Strict Middling**	SMSp.	**SMT**	SMYS
MG	MEW	**No. 5, or Middling**	MSp.	**MT**	MYS
	SLMEW	**No. 6, or Strict Low Middling**	SLMSp.	**SLMT**	
	LMEW	**No. 7, or Low Middling**	LMSp.	**LMT**	
	SGOEW	**No. 8, or Strict Good Ordinary**			
	GOEW	**No. 9, or Good Ordinary**			

[1] Symbols in boldface type denote grades for which practical forms or grade boxes of the standards are prepared for public distribution. The grades indicated by symbols in roman type are descriptive grades and are not represented by grade boxes. Middling Fair White cotton is that which in color, leaf, and preparation is better than Strict Good Middling. Gray cotton is that which is more gray in color than that in the boxes for White cotton; Spotted cotton is that which in color is between the White and the Tinged; Yellow Stained is that which is more yellow in color than the Tinged; and Extra White is that which is whiter in color than the White grades. The grades shown above the horizontal line are deliverable on futures contracts made in accordance with sec. 5 of the United States Cotton Futures Act. Those below the line are not deliverable on such contracts.

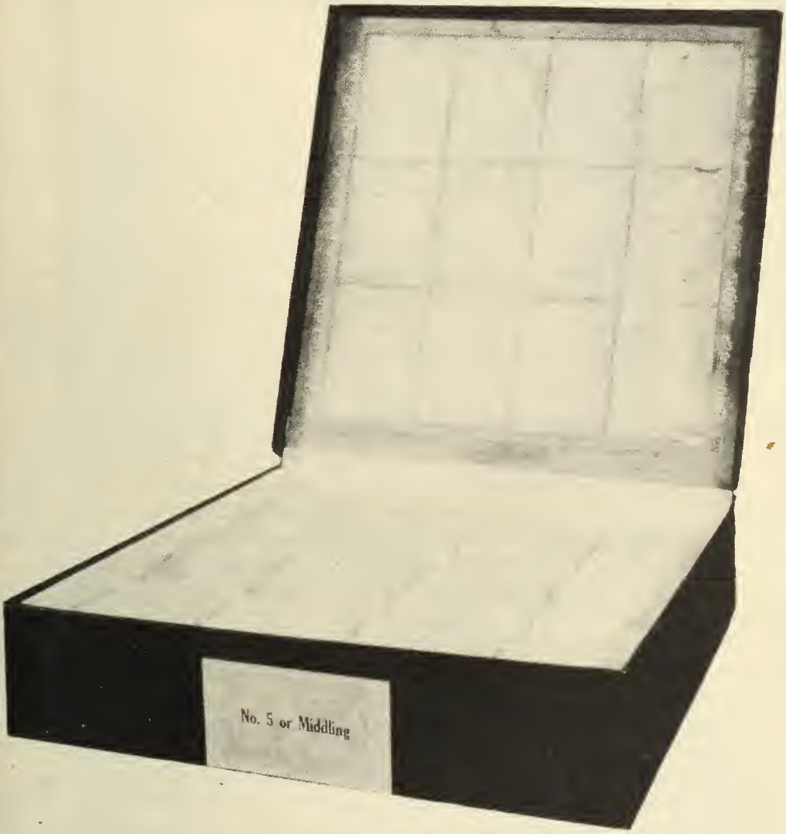
22. **Copies of standards put up in boxes.**—The originals of the standards represented in physical form are sealed and deposited in a vault in the Department of Agriculture at Washington, D. C. Copies of these are prepared and sold at fixed prices. The range of each grade for which there are physical forms is represented by 12 samples contained in a single box, the positions of which are numbered as shown in figure 7. The utmost care is taken to keep all copies of each standard as nearly identical as possible. As evidence of its authenticity, each box is photographed and the photograph is inserted in the cover of the box. The photograph bears the signature of the Secretary of Agriculture and is imprinted with the seal of the Department. A comparison of the photograph with the surface of the cotton in the box will generally disclose whether the surface of the cotton has been disturbed or altered in any way. Thus the photograph affords protection to users of the box. Figure 8 is a photograph of a box representing the grade Middling.

23. **Standards for six major color groups.**—As described in the previous discussion of color, the system of grades embraces both major and minor color graduations. The major color classifications of upland cotton for which there are standards are six in number—



BAE 7349

FIGURE 7.—Empty grade standard box, showing the numerical arrangement of the unfilled cartons.



PMA 8131

FIGURE 8.—Practical form for the grade of Middling White upland cotton. A photograph is inserted in the cover of the box to verify the preparation of the cotton and the position of the foreign matter. Each box carries the seal of the Department of Agriculture and the certificate and signature of the Secretary. The other grades for which practical forms are prepared are represented in the same way.

Extra White, White, Spotted, Tinged, Yellow Stained, and Gray. White is the most important color. From White there is a progressive increase of yellow color through Spotted, Tinged, and Yellow Stained. Extra White is brighter and has less chroma than cotton of the White group, whereas from White through Gray the color is progressively darker and duller.

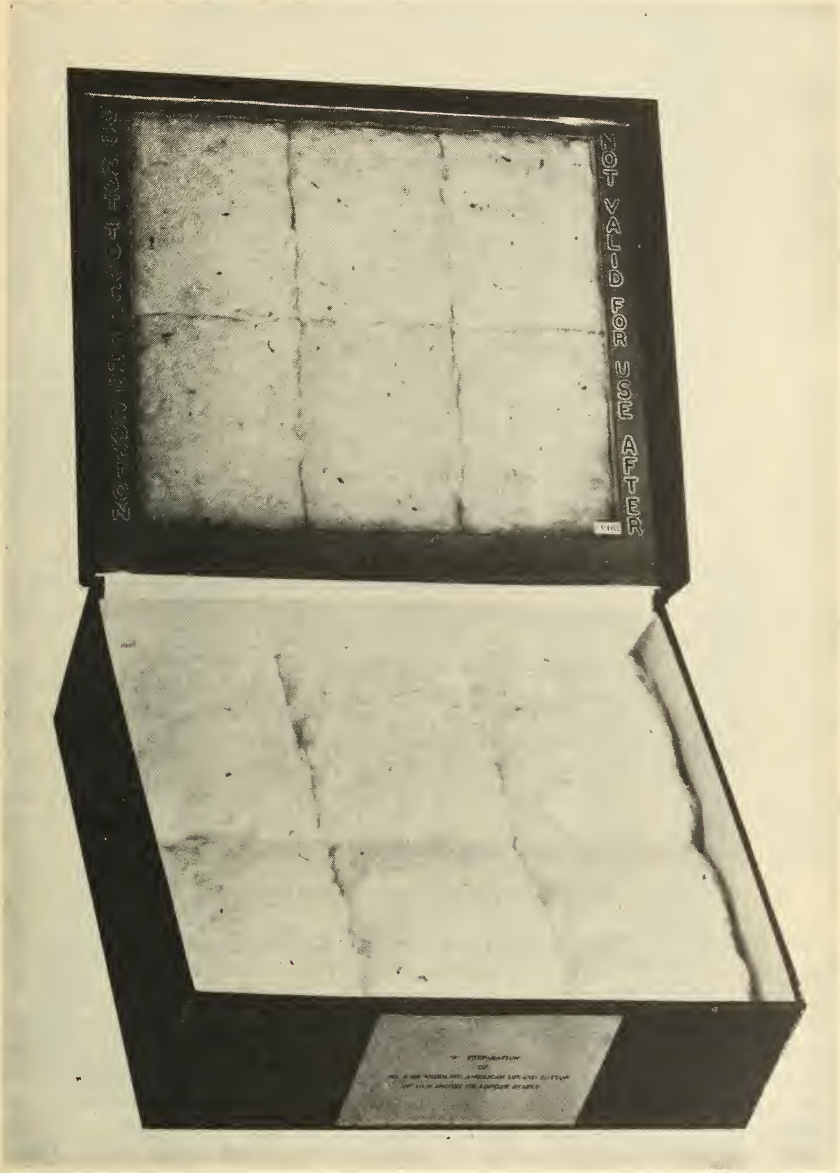
24. **Grade names.**—The terms Middling Fair, Strict Good Middling, Good Middling, Strict Middling, Middling, Strict Low Middling, Low Middling, Strict Good Ordinary, and Good Ordinary, provide a scale from high to low for variation in minor color attributes within any major group, for variation in foreign matter, and for variation in ginning preparation. Only the White standards include the entire range from Middling Fair to Good Ordinary. In accordance with the Department's policy of designating grades for all commodities for which it has established quality standards, a number has also been given to each grade. The numbers 1 to 9 for Middling Fair to Good Ordinary, as is indicated in table 3, are recognized as grade designations equivalent to the grade names.

25. **Foreign matter and preparation in physical standards for grades of colored cotton are equal to that in boxes of White.**—In the standards for color, the foreign matter and preparation of any grade equals that of the corresponding grade of White cotton. For example, the foreign matter and preparation of the box of Middling Tinged is equal to the foreign matter and preparation of the box of Middling White.

26. **Descriptive grades.**—The descriptive grades are defined for color by the grades represented in physical form which are adjacent to them, and the foreign matter and preparation are defined by reference to the White grades. For example, Middling Spotted cotton is that which in leaf and preparation is Middling but which in color is between Middling White and Middling Tinged. If the staple is 1⅛ inches or longer, however, the preparation may be defined by reference to the tentative standards for long-staple cotton.

In reality, color is the only grade factor that is descriptive, since reference to actual standards defines both foreign matter and preparation.

27. **Tentative standards for preparation.**—Although the factor of preparation is shown in the boxes for each White grade, preparation has been separately treated in the classification of the longer staples, of the grades Strict Middling, Middling, and Strict Low Middling, by the establishment of tentative standards announced in May 1929 (p. 54). Of the tentative standards for preparation of long-staple cotton there are nine boxes with six samples in each. Figure 9 is from a photograph of one of these boxes. Three gradations of preparation, designated as A, B, and C, were established for each of the three grades. Preparation A is free from perceptible gin-cut fibers, and from neps, naps, stringy cotton, etc. The surface of the sample is relatively smooth with the fibers laid evenly. Preparation B is slightly rough, with the fibers showing some irregularity in their alignment with each other, and a slight amount of neps and naps. The crop of long-staple cotton is predominantly B, and B is therefore ordinarily regarded as "normal preparation for cotton having a staple length of 1⅛ inches and longer." Preparation C shows considerable roughness with both neps and naps prominent throughout the sample.



BAE 27554

FIGURE 9.—One of the tentative standards for preparation of long-staple cotton.

28. **Grade not specified without reference to all three grade factors.**—No grade is completely specified without implied or actual reference to standards for the three grade factors—color, foreign matter, and preparation. Whenever a grade is named without specific reference to color or to preparation, it is assumed that it equals, or is within the range of, a standard for White cotton. Middling, for example, when it stands by itself, refers to cotton with color, foreign matter, and preparation within the range of the standard for Middling White cotton.

29. **American-Egyptian grade standards.**—Standards for American-Egyptian cotton are prepared in physical form in five grades (p. 49). They are: American-Egyptian grades No. 1, No. 2, No. 3, No. 4, and No. 5 (fig. 10). There are also four descriptive half grades which fall between those represented in physical form. They are: American-Egyptian grade No. 1½, No. 2½, No. 3½, and No. 4½. When such cotton is lower in grade than No. 5 it is designated as below grade 5.

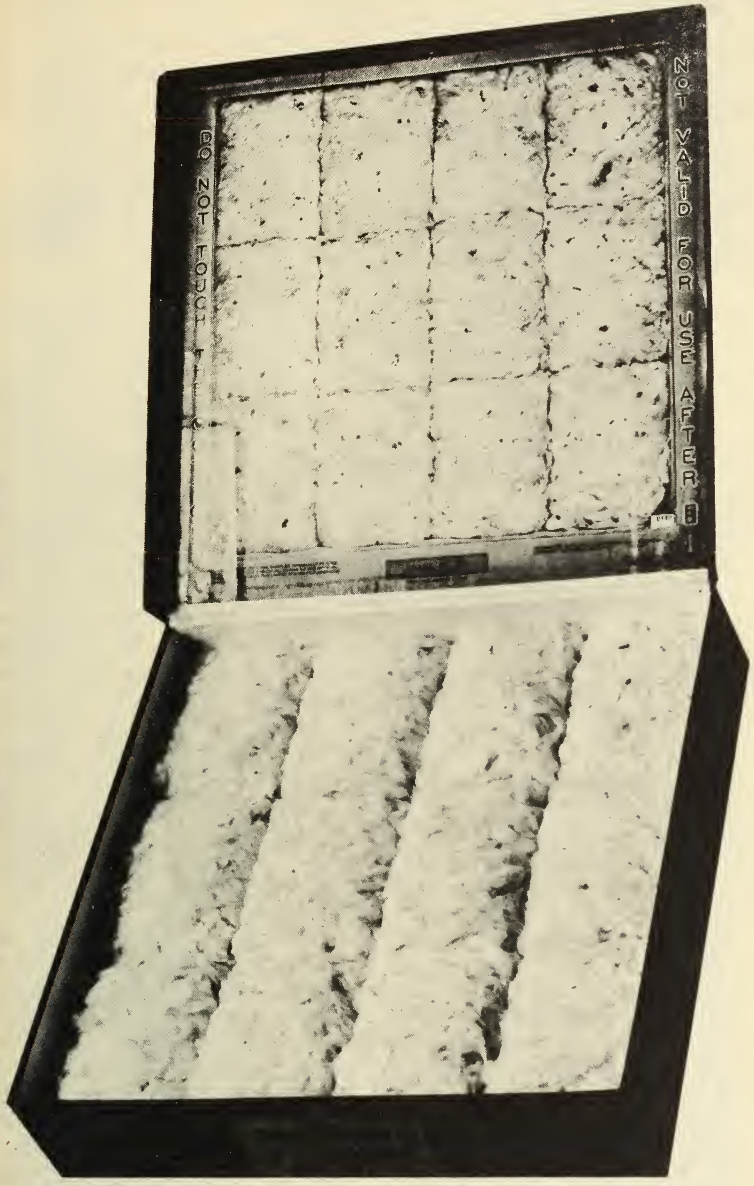
30. **American-Egyptian and upland grade factors differ.**—American-Egyptian cotton is of a deeper yellow color than that of upland cotton. The leaf content of the standards for American-Egyptian is peculiar to this cotton and does not match that in the upland standards. The preparation is very different from the preparation of the standards for upland cotton, for American-Egyptian cotton is ginned on roller gins and therefore looks more stringy and lumpy (fig. 10).

31. **Permissive status of some standards.**—In the promulgation of revisions of the standards for both grade and staple, the Secretary of Agriculture customarily provides in his order that between the date of promulgation and the effective date of such changes or revisions, the new or revised standards may be used permissively in the purchase or sale of cotton in spot transactions. A check list of standards issued annually by the Bureau of Agricultural Economics shows the current status of all cotton standards.

32. **Year's notice before change in standards.**—Both the Cotton Futures Act and the Cotton Standards Act provide for 1 year's notice of a change or revision of the standards for either grade or staple. Changes have not been frequent.

E. THE DETERMINATION OF GRADE

33. **General considerations.**—The grading and classing of cotton is usually associated with its purchase or sale. In practice, classing may be done in two ways. If the cotton is classed before its sale, the purpose of classification is usually to arrive at an exact and precise description of its quality. On the other hand, if the basis price, grade differences, and staple premiums and discounts have been agreed upon in advance, the primary purpose of classing is to determine the value of the cotton for purposes of settlement. If the cotton to be classed matches the standards, the method is in either case the same. If, on the other hand, the cotton to be classed does not match within reasonable limits any one of the standard boxes or descriptive grades, the method to be used will necessarily differ, as will be apparent from the following outline.



BAE 27551

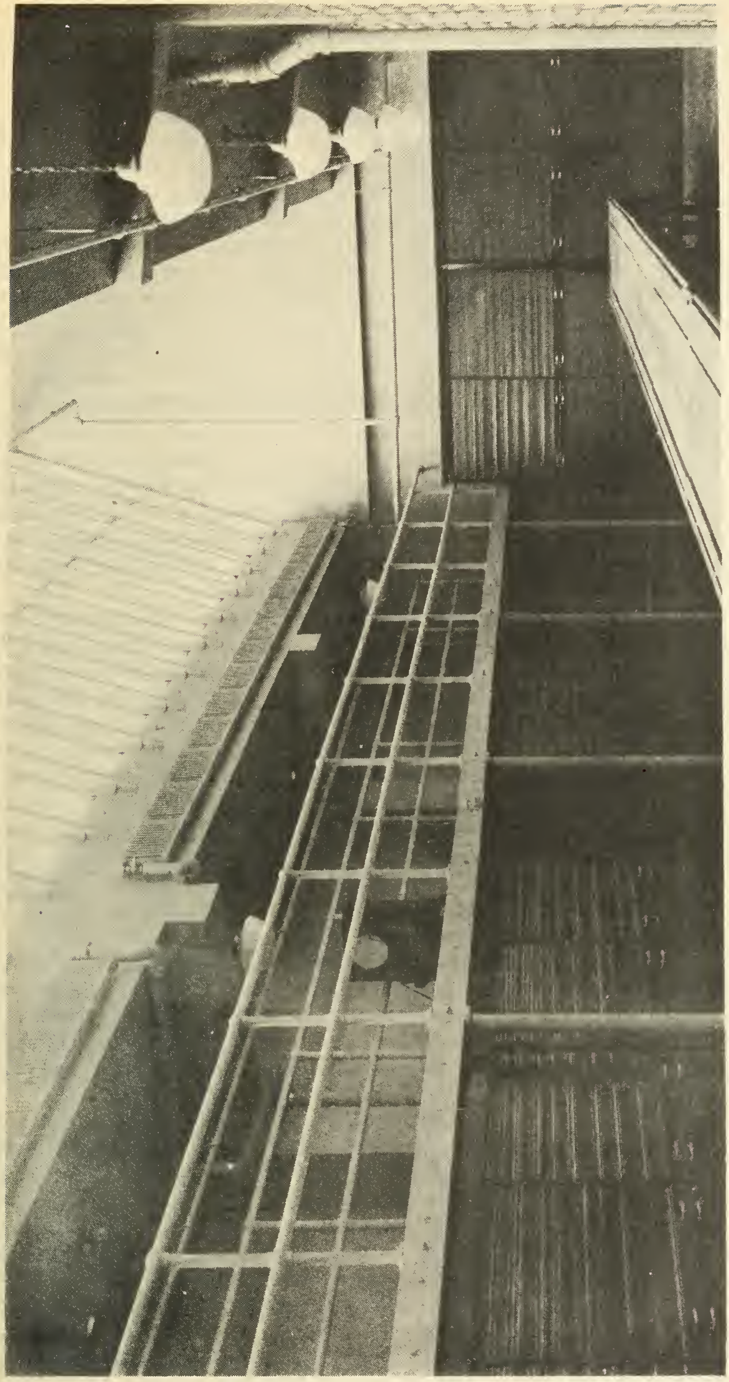
Figure 10.—Practical form of the standard for American-Egyptian cotton, grade No. 3. The preparation of this cotton differs from that of short-staple cotton because it is ginned on roller gins instead of saw gins.

Averaging the various grade factors to arrive at composite grade	*Grading to establish a detailed description*
1. When employed: (a) Purchasing cotton on limits and differences. (b) Delivering cotton sold on basis of some specific grade. (c) In classing for delivery; in settlement of futures contracts.	1. When employed: (a) Offering specially selected cotton for sale. (b) Purchasing cotton to meet special requirements.
2. Object: To find a single grade description upon which to base the average of all the factors of grade (leaf, color, and preparation).	2. Object: To describe exactly in terms of the standards or types each of the separate factors of leaf, color, and preparation.
	3. Variations of method: (a) Subgrading. (Describing according to certain positions within a standard box.) (b) "Split" grading. (Describing leaf according to one grade box and color and/or preparation according to another.)

34. **Importance of lighting conditions.**— Light and the position of the classer's body with respect to it are important, especially when classing is to be done under any light except that from a skylight. In this country, light from a north sky, because it provides the steadiest color of natural light, is ordinarily preferred for classing. If light from a window is used, the surrounding conditions in the room—the walls, ceiling, etc.—should be observed carefully, and note made of nearby buildings so that due regard may be given to any reflection that may be cast into the classing room from such sources. When lighting conditions in the classing room are satisfactory, the tables on which the samples are laid should be placed far enough from the window to avoid any very bright light or direct sunlight. The classer's back should be kept to the window while he is classing, the light coming from over his shoulder. If the classing is to be done under a skylight, the table should be placed so as to insure a correct balance of light. It should not be placed under the edge of the skylight opening, nor in too strong light, as either of these conditions tend to make correct classification difficult (fig. 11).

35. **Directions for handling samples in grading.**—In lifting the sample from the table preparatory to classing, one hand should be placed on the top side with the fingers slightly spread apart. With a light hold, the sample should be turned in order that the other side may be clasped with the free hand and the sample thus lifted to such a position as to secure the best light. The best position—usually 12 to 18 inches from the eyes—is slightly below the shoulders. The sample should be inspected for color, foreign matter, and preparation, both while on the table and as it is picked up. To open the sample, the thumbs should be pressed lightly into the top edge and the layers gently opened and closed, as if they were pages of a book. As the sample is thus opened and closed, each layer should be closely observed for color, for foreign matter, and for preparation.

36. **Regulations.**—In the regulations of the Secretary of Agriculture under the Cotton Futures Act and the Cotton Standards Act it is stated: (1) That the classification of all cotton samples shall be according to the official cotton standards of the United States in effect



PMA 5961

FIGURE 11.—Government classing room in Washington, D. C. The skylight has been used as a model for skylights installed in the classing rooms of many cotton firms, cooperative associations, and trade organizations.

at the time; (2) that if a sample drawn from one portion of a bale is lower in grade than one drawn from another portion of such bale, except as otherwise provided in the regulations, the classification of the bale shall be that of the sample showing the lower grade; and (3) that if cotton be reduced in value, by reason of the presence of extraneous matter of any character or irregularities or defects below its grade according to the official cotton standards of the United States, the grade from which and to which, and the quality or condition which so reduces its value, shall be determined and stated.

37. **Samples differing in successive "breaks."**—It often happens that different breaks or openings of a sample are unlike in color, foreign matter, or preparation. The grade of cotton should not be determined by either the lowest and poorest nor the highest and best opening in the sample. After opening it several times, the final decision should be made by averaging all breaks or openings. A reasonable allowance should be made between the two sides of the sample before any reduction is made in the grade assigned. This method of classing is not meant to be used in classing two-sided bales but should be employed in classing cotton that shows slight variations in different breaks. If a sample shows distinctly that the bale is composed of cotton of different grades, such as Strict Middling on one side and Middling on the other side, the bale should be graded on the low side in accordance with the regulations.

38. **How to compare samples with standards.**—When it is necessary to match the sample against one of the official standards for grade, the sample should be rolled so as to give it a surface or face as nearly like that of the type samples as possible, and then held by the side of the box representing the grade in question in a position that will give the same light to both (fig. 12). If some special factor is in question, it should be compared with the sample in the standard box which shows this particular factor. In making these comparisons, the faces of the samples in the boxes should never be disturbed, and the classer should exercise care to prevent any foreign substances from falling upon the surface of the samples in the standard box. The boxes, when not in use, should be kept closed and should be stored in a convenient place for ready reference.

39. **Classing on descriptive standards.**—In classing cottons that fall within descriptive standards for grade, comparison should be made with the standard boxes adjacent to the sample in question. For example, if a sample appears to be Good Middling Spotted, it should be compared with both the Good Middling Tinged and the Good Middling White boxes to be sure that it falls between them.

40. **Value class should be that of nearest grade standard, not grade of equivalent value.**—There are instances in the buying and selling of cotton in which an equivalent White grade, rather than the appropriate color class, is given to the cotton. From the viewpoint of value it may not make much difference whether the cotton is classed as equivalent to a White grade or, more accurately, as Extra White or Spotted, yet an accurate value class would specify the *nearest* and not merely an *equivalent* grade. When publishing figures in Government reports, it would be entirely incorrect to use an equivalent. instead of the nearest, grade since the proportion of samples in any single grade might be quite different if the figures were assembled in such a way. The concept of value classing and the necessity for

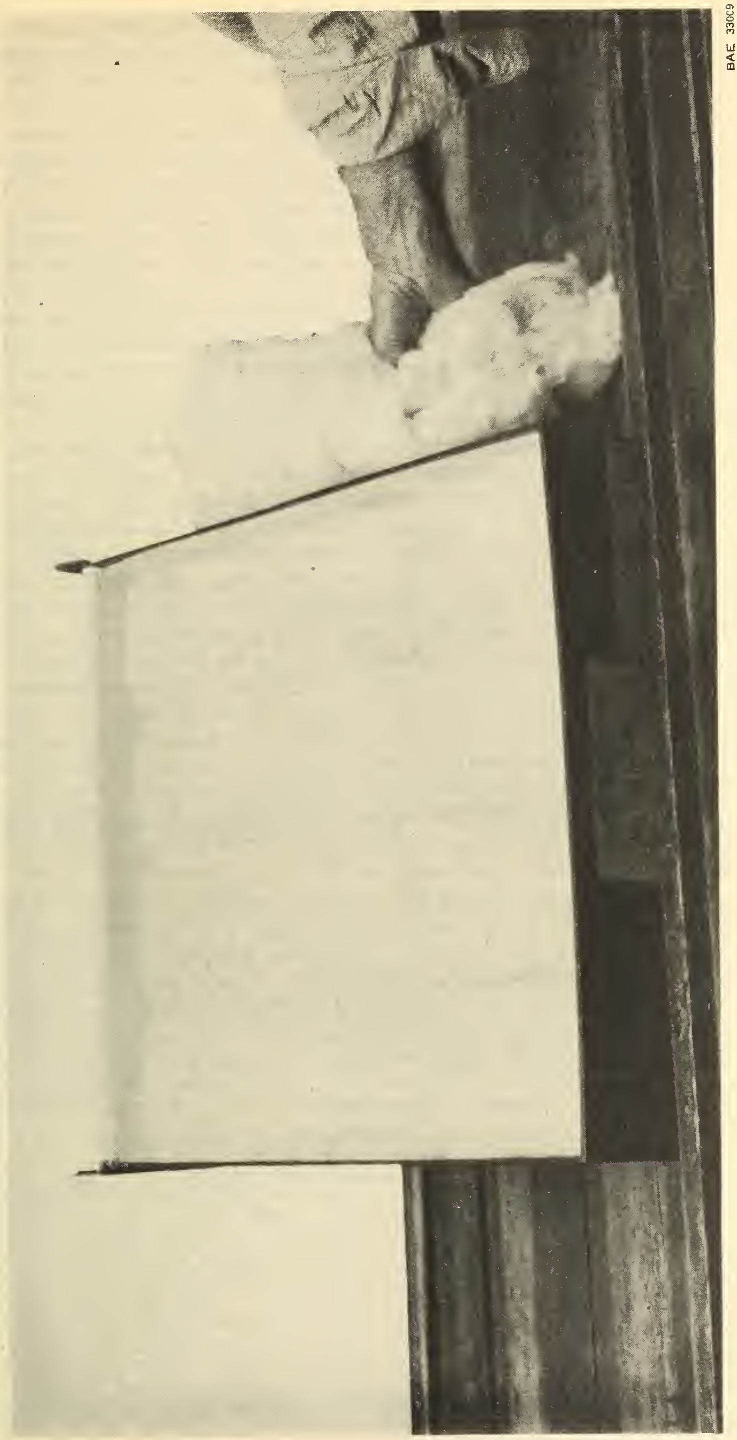


FIGURE 12.—The proper method of comparing samples with the standards for grade.

such classing are very real; but it should be emphasized that when it is necessary to use a value class, the grade of the nearest standard to the composite of the factors should be used rather than a grade of about the same value.

41. **Grading against individual samples in standards box.**—Each of the grade standards is composed of 12 samples of cotton differing slightly in grade factors, thus creating what is called the range within each box. It may be necessary to compare a sample with one of the small samples in the standard box for color, with another for foreign matter, and with a third for preparation. Any sample that possesses grade factors that come within the range of any single standard, regardless of how these factors are combined, should be classed as of that particular grade. In such a case the results of classing based on the standards and on the value class will be identical. In some instances the specification of cotton equal to certain positions within a grade box may be useful as a subclassification.

42. **Averaging factors of grade.**—Sometimes samples have no two grade factors that fall within the range of any one grade. A sample may be Middling in color, Strict Middling in foreign matter, and Strict Low Middling in preparation. If the color is equal to the average or better than the Middling standard, and the foreign matter is equal to the average or better than the Strict Middling standard, and the preparation is equal to the average of the Strict Low Middling standard, the value class is Middling. The general rule for averaging factors of grade is given in the order of the Secretary of Agriculture promulgating the standards for grade for upland cotton, as follows:

> American upland cotton which in color, leaf, and preparation is within the range of the standards established by this notice, but which contains a combination of color, leaf, and preparation not within any one of the definitions herein set out, shall be designated according to the definition which is equivalent to, or if there be no exact equivalent is next below, the average of all the factors that determine the grade of the cotton: *Provided*, That in no event shall the grade assigned to any cotton or sample be more than one grade higher than the grade classification of the color or leaf contained therein.

43. **Split designations.**—When cotton cannot be directly matched against boxes nor properly placed in descriptive grades, it is sometimes difficult to assign a value class. The cotton may then be described by its more precise standards classification as, for example, Middling color and preparation, Low Middling foreign matter. Such designation is sometimes called a split designation. It is equivalent to what has been described as a standard class for the separate grade factors.

F. METHOD OF GRADING IRREGULAR AND SPECIAL-CONDITION COTTON

44. **Classification of special conditions.**—Bales in which special grade conditions are found to which it is practicable to give a grade value should be classified as any normal bale, but to the classification data there should be added a notation fully descriptive of the special condition, which will permit the bale to be segregated from other bales having normal grade factors (items 47–56). Whenever it becomes necessary to assign to such a bale of cotton a classification that embraces only a single grade designation, the classification should be reduced to that which corresponds to the value of the bale. In all such instances the grade from which and the grade to which the reduction is made, and the special condition or conditions on account of

which the reduction is made, must be fully and clearly stated. Bales to which it is impracticable to give a grade value on account of excessive irregularity should be classified only under the designations that describe such irregularity.

45. **Snapped and sledded cotton.**—Snapping and sledding sometimes produce regular, sometimes irregular, cottons. Snapped cotton is gathered by hand, the entire open boll being snapped off the plant. Sledded cotton is gathered by mechanical devices, and some immature bolls may be gathered. Such cotton must go through special cleaning equipment at the gin, through hull extractors in particular. Sometimes cleaning and ginning of snapped cotton are so well done that it is difficult, if not impossible, to distinguish such cotton from picked cotton. Cotton that is considered to have the merit of picked cotton is not discounted on account of the method of gathering. In grading this cotton, the classer should be guided by the quantity and kind of foreign matter and the condition and quality of the lint, as well as by the usual elements of grade. Fine particles of shale are much more objectionable than large particles because, in manufacturing, the fine bits of shale appear in the yarn, whereas the large ones, though undesirable, are more readily removed.

46. **Bolly cotton.**—Bolly cotton is cotton in which growth is stopped by frost before the bolls are fully matured. In harvesting, no attempt is made to separate the unopened bolls from those that are open. Instead, all bolls are indiscriminately gathered and carried to the gin, where they are subjected to the cleaning process, which separates the seed cotton from the bolls, after which the cotton passes through the gin breast to separate the seed from the lint. Bolly cotton may be more or less stained and usually contains considerable foreign matter such as pieces of the cotton stalk, leaves, bits of burs, and shale. The fibers of such cotton are usually weak and irregular.

47. **Gin-cut cotton.**—Gin-cut cotton is cotton that shows damage in ginning, through cutting by the saws, to an extent that reduces its value more than two grades. (If gin damage is less than sufficient to reduce the value of cotton more than two grades it should be regarded as a defect of preparation and treated as a factor of grade.)

48. **Reginned cotton.**—Reginned cotton is cotton that has passed through the ginning process more than once, or cotton that, after having been ginned, has been subjected to a cleaning process and then rebaled. (It will be noted that the definition includes cotton which, after having been once baled, has been subjected to a process of recleaning.)

49. **Repacked cotton.**—Repacked cotton is cotton that is composed of factor's, broker's, or other samples, or of loose or miscellaneous lots that have been collected and rebaled, or cotton in a bale which is composed of a part of a larger bale, or of two or more smaller bales or parts of bales. (This definition is construed to include bales of cotton made up by the "marriage" of two or more lighter bales but not to include sound bales of cotton of uniform quality that have been opened to permit the removal of a plate or the reconditioning of the package, and that have then been repressed without the addition of cotton foreign to the original bale.)

50. **False-packed cotton.**—False-packed cotton is cotton in a bale (1) containing substances entirely foreign to cotton, (2) containing damaged cotton in the interior with or without any indication of such damage upon the exterior, (3) composed of good cotton upon the

exterior and decidedly inferior cotton in the interior, in such manner as not to be detected by customary examination, that is, a "plated" bale, or (4) containing pickings or linters worked into the bale.

51. **Mixed-packed cotton.**—Mixed-packed cotton is cotton in a bale which, in the samples drawn therefrom, (1) shows a difference of more than two grades, if of the same color; or (2) if of the same grade name but of different color, shows a difference of more than two color gradations; or (3) shows a difference of two or more grades and two or more color gradations; or (4) shows a difference in length of staple exceeding three thirty-seconds of an inch. (If the differences in quality are not so great as these, they may be disregarded and the cotton graded on its low side or stapled on its short side.)

52. **Water-packed cotton.**—Water-packed cotton is (1) cotton in a bale that has been penetrated by water during the baling process, causing damage to the fiber, or (2) a bale that, although apparently dry on the exterior, through exposure to the weather or through other means has been damaged by water in its interior.

53. **Other special conditions.**—In addition to these irregular cottons which are defined in the regulations under the Cotton Futures Act and the Cotton Standards Act, cotton sometimes has other special conditions of irregularity or defects of qualities which are not normally found in regularly ginned and baled cotton. Examples of these conditions are sandy, dusty, oil-stained, and seedy cottons.

54. **Dusty and sandy cottons.**—Samples showing sand or dust are usually reduced in grade, the reduction depending upon the quantity present. If an excessive quantity of either sand or dust is present, the cotton should be classed and designated as sandy or as dusty.

55. **Oil-stained cotton.**—Oil-stained cotton is cotton that has become more or less saturated with oil during the ginning process. It is usually recognized by its feel and by its odor.

56. **Seedy cotton.**—Seedy cotton is that in which, during the ginning process, a considerable number of whole seeds as well as parts of seeds have been left mixed with the lint.

G. INACCURACIES IN GRADING COTTON

57. **Common errors in grading.**—The usefulness of a system of classification of cotton, as of any other classification, is dependent primarily upon the uniformity with which the system of standards can be applied.

The establishment and distribution of fixed standards to which classers can refer for guidance has done much to promote uniformity of classing. Nevertheless, differences and inconsistencies in the results obtained from the classification of the same samples by different classers or by the same classer at different times are not unusual. Because cotton classing in its present state of development depends upon human perceptions of sight and touch and involves the exercise of human judgment, the grade determinations of cotton classers are subject to the inexactness and vagaries of the human factor. But it is, of course, the duty of classers to reduce in so far as possible the number and extent of variations and inconsistencies of classing. By careful study, many of the common inconsistencies in the classing of cotton for the factor of grade can be eliminated; and many others can be reduced, as their nature is recognized, their causes are learned, and remedies are developed.

58. **Sources of variations in grading.**—Variations in classing can be traced, in general, to three sources:

(a) The sample. Its homogeneity, representativeness, and, in some cases, its size and condition have to be considered.

(b) The classer himself. His knowledge of standards and skill in applying them, the stability or instability of his nervous system, and his indifference to or his susceptibility to influence by information as to a previous classification affect his decisions.

(c) The conditions under which the classing is done, that is, light, atmospheric humidity, etc.

59. **Types of variation—causes and remedies.**—Some of the common sources of variation in grading, along with causes of the variation and a few suggestions as to how variations may be remedied are listed in table 4.

TABLE 4.—*Variations in grading—some causes and remedies*

Type of variation	Cause	Remedy
1. Bias		
(a) Consistent bias—tendency of classer to be hard or easy.	1. Constitutional tendency. 2. Previous experience or training not in line with standards.	Recognition of specific tendency, along with complete knowledge of and frequent reference to the standards.
(b) Occasional bias.	1. Suggestion. 2. Prejudice. 3. Physiological or psychological condition of classer. 4. Temporary misconception of standards.	Frequent reference to the standards. Classing the samples without knowledge of source or of classification previously assigned.
2. Irregularity—erratic classification.	1. Unfamiliarity with standards. 2. Physical or nervous condition of the classer. 3. Lack of care.	Complete knowledge of and frequent use of grade standards.
3. Disregard of 1 or more of the major steps of graduation.	1. Incomplete knowledge of the grade scale.	Frequent study of grade standards and frequent reference to and study of classing results.
4. Tendency to group the samples toward Middling or the average of the lot.	1. Classing too rapidly and assuming a lack of variation between samples in the lot.	Careful examination of each sample for each of the grade factors.

60. **Bias resulting in hard or easy classification.**—Some classers show a tendency to be consistently hard or easy in grading cotton. Some may be aware of the fact, but there are many who are unaware of the wide difference that such a tendency may cause in the classing of a relatively large number of samples.

61. **Prior experience or knowledge of previous classification an influence.**—Some classers are sometimes influenced by the knowledge of where the cotton came from, for example, a prejudice for or against cotton from a specific district from which they have at some time received very good or very poor cotton. Sometimes they are influenced by knowledge of a previous classification, as for example, when it is known that the cotton has been classed by another as being of a certain grade or grades. In such a case a classer may subconsciously tend to look for and find these grades, whereas if he had exercised his own judgment unaffected by the judgment of another, the result might have been more accurate.

62. **Erratic classification.**—There is sometimes a tendency to be too easy at one time and too hard at another, usually caused by a vagueness in knowledge of the official standards against which the classing should be done. Until a classer is thoroughly familiar with the standards or types against which he is working, it is impossible for him to proceed with confidence, and as a result erratic classification will follow.

63. **Failure to use certain grades.**—Variation in grading sometimes occurs because some classers fail entirely to refer to or use some of the standards for color and grade when making grade classification. A careless or an improperly trained classer, for example, may fail to make use of the descriptive spotted grades. Another may ignore gray cotton or perhaps some other particular grade-color combination.

64. **Tendency to group the samples toward Middling.**—One of the most common tendencies is for the grading to be grouped toward Middling or toward the grades near the center of the range of grades. This may occur irrespective of the actual comparability of the samples and is caused by a lack of familiarity with the adjacent standards and by carelessness. Cotton that should be graded Strict Middling Spotted, Strict Middling, or even Strict Low Middling (white) may often be classed Middling.

65. **Nonrecognition of grade factors.**—Sometimes the grade factors of color, foreign matter, and preparation are not recognized or are appraised incorrectly, either because of too rapid classing or impaired vision, or because of lack of understanding of the relative weight of each of the grade factors or of ability correctly to apply them in arriving at the classification to be assigned to the sample.

66. **Insufficient care.**—Carelessness in examining samples for special conditions and for plated or two-sided bales is another cause of error in classification. A bale that may be Middling on one side and Strict Middling on the other may be called Strict Middling because in a too rapid examination the Middling side was not inspected properly.

67. **Inadequate samples.**—Some of the errors in classing may be traceable to an attempt to class samples that are too small to represent accurately the cotton in the bale. The class of the sample may be correct, but it may not be the true class of the bale from which the sample was drawn. Undoubtedly other differences are due to improperly conditioned, poorly handled, or excessively handled samples which, because of such conditions, fail to be representative of the bale.

68. **Lack of good light.**—Other errors are due to classing under poor lighting conditions, as for example, the failure to recognize spots which would have been readily recognizable under better lighting conditions.

69. **Errors can be reduced.**—Many of these errors or variations in classing can be reduced (1) if the classer will refuse to class under poor light; (2) if he will carefully examine each sample for special conditions or irregularities; (3) if he will class each sample on its merits, regardless of growth or any previous class assigned it; (4) if he will weigh and properly balance the grade factors; and (5) most important, if he will obtain and maintain a thorough familiarity with the official standards through study and through constant and continued reference to them.

70. **Thorough knowledge of standards necessary.**—The importance of a knowledge of the official grade standards to accurate cotton grading cannot be overemphasized. Any classer is likely to be unduly influenced by previous training in which he may have assumed a knowledge of the standards when he was actually unfamiliar with all the grade and color combinations. Every cotton classer should therefore concentrate on the official grade standards and should use them until he is entirely familiar with each and every standard taken separately. The standards should be studied until a picture of each is indelibly imprinted on the mind, as well as the sets as a whole. These official standards are the classer's guide, and it is essential that he develop an

ability to state quickly and accurately the grade which most nearly matches the sample in question. This ability, once acquired, can be retained only by frequent reference to the standards. The grade boxes should be carefully examined and compared each morning before the day's work begins. Thus temporary deviation from them can ordinarily be avoided.

H. FACTORS OF STAPLE AND THE STANDARDS FOR STAPLE

71. **Staple length defined officially.**—Staple length of cotton is defined in the original order promulgating staple standards as follows:

> The length of staple of any cotton shall be the normal length by measurement, without regard to quality or value, of a typical portion of its fibers under a relative humidity of the atmosphere of 65 percent and a temperature of 70 degrees F.

In amplification of this definition, the order enumerates certain of the recognized lengths in terms of the standard inch and fractions thereof (pp. 35, 53).

72. **Staple length an important quality factor.**—Staple is one of the most important factors of quality because, other factors being equal, longer staples are required in spinning the finer yarns, and in yarns of a given fineness, longer staple cottons ordinarily produce greater strength than do shorter staples.

73. **Lengths of fibers in a sample.**—When fibers from a sample of cotton described as being 1$\frac{5}{32}$ inches in staple length are arrayed they have been found to range from less than one-eighth of an inch up to 1⅝ inches in length (fig. 13). To make this array, the longest fibers were carefully selected and placed at the left of the array, and the fibers of each succeeding length were placed immediately to the right. This process was continued until the shortest fibers, shown at the extreme right of the photograph, were placed (fig. 13).

74. **Fibers rejected in classer's pull.**—The smooth curved line in figure 14 represents the fibers in the sample from which a pull was made, and the broken curved line is the diagram of the fibers in the pull itself. From this diagram it is easy to see which fibers were rejected and which were retained during the process of pulling or stapling. It will be observed that some of the long and some of the short fibers were disposed of, but that some of both were retained.

75. **Promulgation of official standards for staple.**—The order of the Secretary of Agriculture of October 25, 1918, promulgating the standards for staple provides for the designation of various lengths in terms of inches and fractions of an inch from below three-fourth inch upward in gradations generally of thirty-seconds of an inch to 1¾ inches, disregarding any fraction less than a thirty-second. In the same order of promulgation the issuance of practical forms of the standards was authorized for the lengths ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1⅝, and 1¾ inches (fig. 15). Although the linear inch is the basic standard, in determining the normal length by measurement of a typical portion of fibers in a given sample, the process of stapling is facilitated by the use of such practical forms, which are also known as official staple types. Because of variable atmospheric conditions and of the greater ease of comparison, the staple types are more often used in staple determination than is the linear rule. When the staple type is properly pulled under standard conditions the classer's pull will measure the length indicated on the standard package when the rule is placed against it.

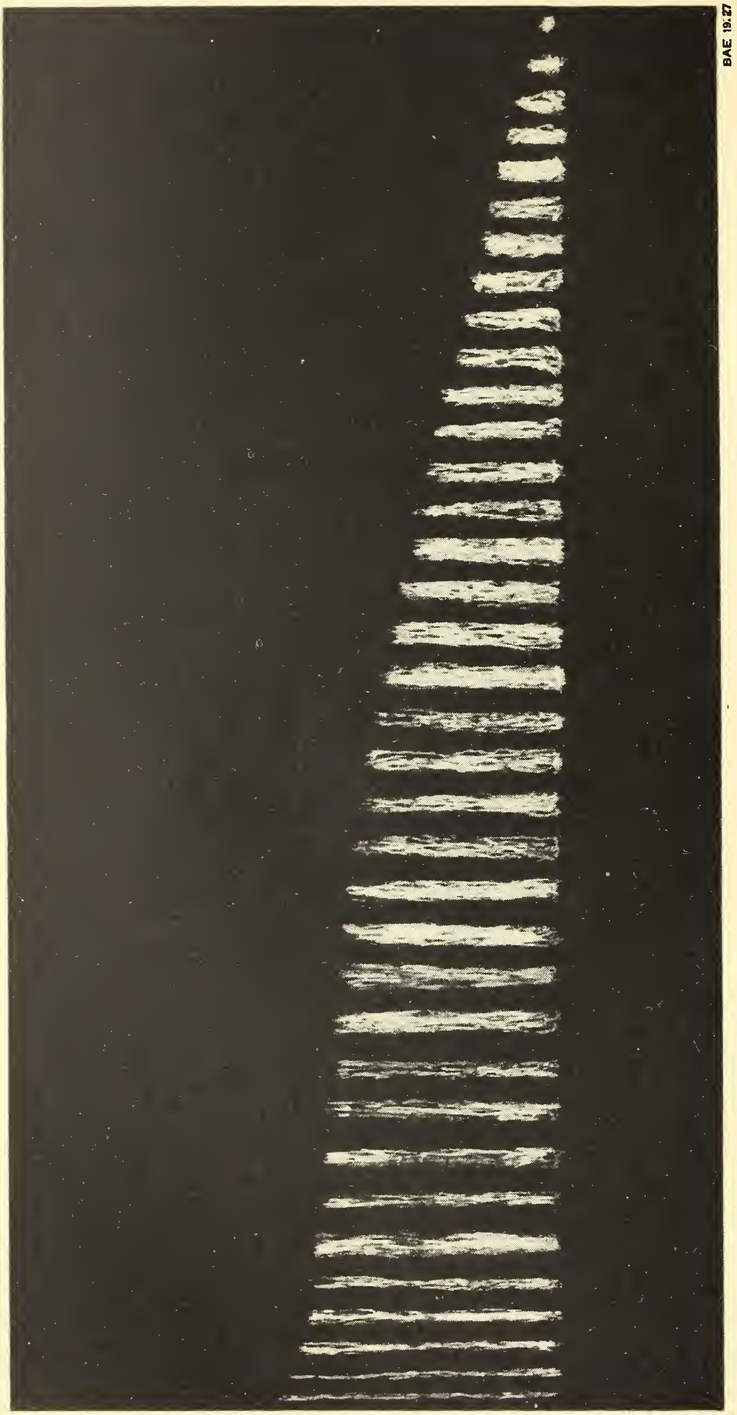
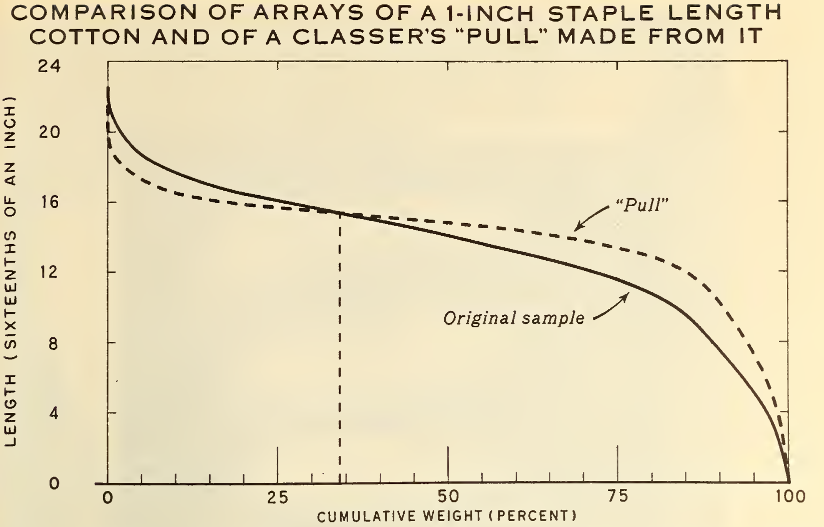


FIGURE 13.—An array of the fibers found in a sample of cotton called 1$\frac{5}{32}$ inches in staple. The fibers range in length from less than one-eighth inch up to 1$\frac{5}{8}$ inches.



BAE 32889

Figure 14.—Diagram of fiber arrays made from a classer's pull and from a sample of the bale from which the pull was made, indicating what part of the fibers the classer discarded in making his pull.

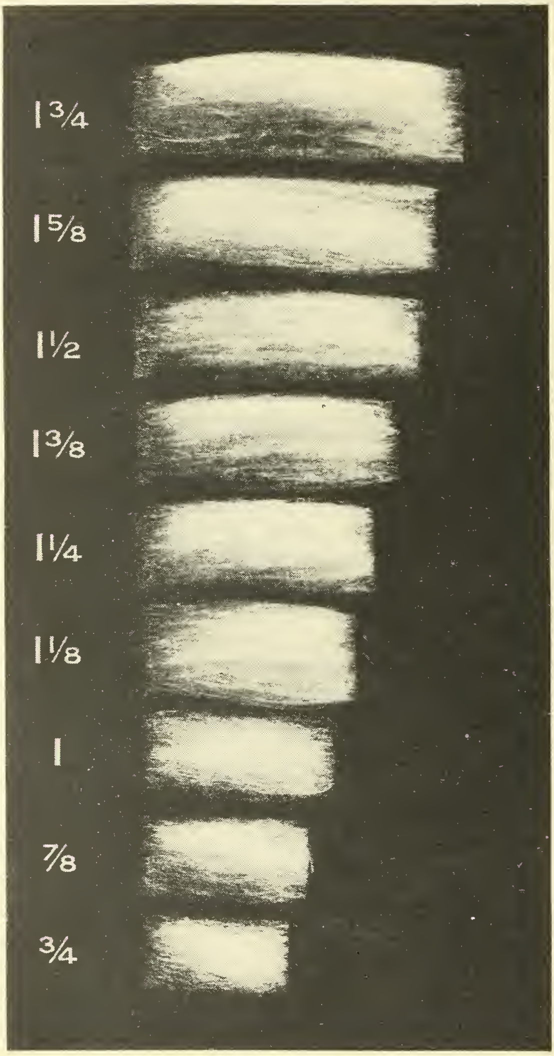
76. **Original promulgation order amended.**—Since 1918 the original order promulgating the standards for staple has been amended from time to time under authority of both the Cotton Futures Act and the Cotton Standards Act by authorizing the issuance of staple types for additional lengths. Such types are available in 1938 for American upland cotton of the lengths $\frac{3}{4}$, $\frac{13}{16}$, $\frac{7}{8}$, $\frac{29}{32}$, $\frac{15}{16}$, $\frac{31}{32}$, 1, $1\frac{1}{32}$, $1\frac{1}{16}$, $1\frac{3}{32}$, $1\frac{1}{8}$, $1\frac{5}{32}$, $1\frac{3}{16}$, $1\frac{7}{32}$, $1\frac{1}{4}$, $1\frac{9}{32}$, $1\frac{5}{16}$, $1\frac{11}{32}$, $1\frac{3}{8}$, and $1\frac{1}{2}$ inches, respectively; and for American-Egyptian cotton of the lengths $1\frac{1}{2}$, $1\frac{9}{16}$, $1\frac{5}{8}$, and $1\frac{3}{4}$ inches (p. 58).

77. **Types match original representations.**—The staple types are prepared from bales selected to match the original representation of each of these lengths. The original representation consists in each instance of an entire bale of cotton stored in a vault in the Department of Agriculture in Washington. Each staple type, as prepared for sale to the public, contains approximately 1 pound of raw cotton and bears on its wrapper a statement of the standard length of staple which it is issued to represent, certified to by the Secretary of Agriculture (fig. 16).

78. **Staple types represent normal character.**—In the absence of official standards for character, the specialists in the cotton standardization work have carefully selected the bales to be used in the preparation of staple types from cotton which they considered to be of normal character.

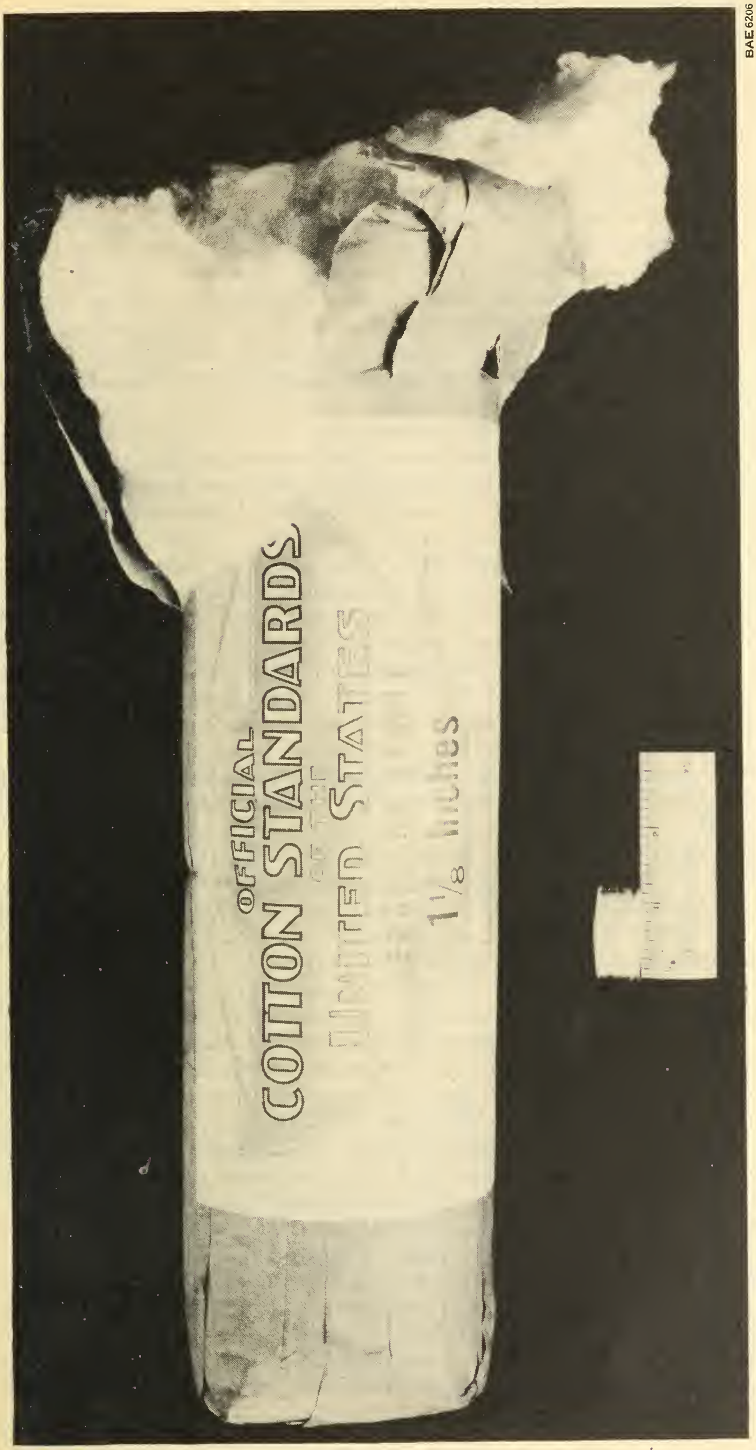
I. METHOD OF STAPLING

79. **Regulations concerning stapling.**—The classification of cotton according to length of staple should be considered in conjunction with provisions of the regulations of the Secretary of Agriculture under both the Cotton Futures Act and the Cotton Standards Act which state: (1) That if the sample drawn from one portion of a bale is shorter in length than one drawn from another portion of the bale,



BAE 2459

FIGURE 15.—Staple lengths. Pulls from types representing the official standards for nine selected lengths of staple.



BAE 6206

FIGURE 16.—A practical form of the official cotton standard for length of staple 1⅛ inches, and a typical pull of fibers from the cotton.

except as otherwise provided in the regulations, the classification of the bale shall be that of the sample showing the shorter length; and (2) that if cotton be reduced in value by reason of the presence of extraneous matter of any character or irregularities or defects below its apparent length of staple according to the official cotton standards of the United States, the length of staple from which it is so reduced and that to which it is so reduced, and the quality or condition which so reduces its value, shall be determined and stated. In addition, there is the provision in the regulations under the Cotton Futures Act that all cotton whether tenderable or untenderable shall be classified on the basis of the official cotton standards of the United States in effect at the time of such classification, and that it shall be deemed a sufficient compliance for the purposes of that act if cotton of tenderable length of staple shall be classified in sixteenths of an inch. These regulations as well as those regarding the conditions of handling and classing the cotton must be observed.

80. **Typical portion selected by stapling.**—In the practical application of the standards, the selection or determination of a typical portion of the fibers of any cotton is made by a process of manual stapling. The method of stapling recommended by the Department of Agriculture is given below.

81. **Instructions for pulling staple.**—Grasp in the two hands a tuft of cotton of a size convenient for the purpose (about one-fourth of an ounce), holding it firmly between the thumb and forefinger of each hand, with the thumbs placed together, the fingers being turned in toward the palms of the hands, and the middle joints of the second, third, and fourth fingers of each hand touching the corresponding joints of the fingers of the other hand, so as to give a good leverage for breaking the cotton (fig. 17, *A*).

Pull the cotton slowly with about the same leverage of each hand on the joints of the fingers, separating the tuft of cotton into two parts (fig. 17, *B*).

Discard the part remaining in the right hand (fig. 17, *C*).

Grasp with the thumb and forefinger of the right hand the end of the tuft of the cotton retained in the left hand. The point of pressure on the cotton in the left hand is just below the joint of the thumb and at the nail joint of the forefinger (fig. 17, *D*).

With the right hand draw a layer of fibers from the cotton held in the left hand (fig. 17, *E*). Retain in the right hand the layer so drawn (fig. 17, *F*). Repeat this operation four or five times, placing each successive layer directly over the fibers previously drawn, using care to see that the ends of all the layers are even with each other between the thumb and forefinger of the right hand (fig. 17, *G*, *H*, *I*, and *J*).

After discarding the cotton in the left hand, hold the fibers thus obtained between the thumb and forefinger of the right hand and smooth them with the thumb and forefinger of the left hand (fig. 17, *K* and *L*).

Place these fibers on a flat, horizontal surface with a black background, preferably black velvet (fig. 17, *M* and *N*).

Block off the ends of the fibers with a cotton-stapling rule, so as to indicate the length of the bulk of the fibers, and measure the distance between the blocked-off ends (fig. 17, *O* and *P*).

If this method is correctly and consistently followed, the length obtained should agree with that obtained by comparisons with pulls from the official staple types.

82. **The break in pulling staple.**—It should not be understood that all classers make a pull in exactly the same way. Some obtain a certain impression of the length from the behavior of the cotton on the break. (Fibers are not actually broken in mass, but are pulled out and separated from each other, in what the classer speaks of as the "break.")

As short, weak, or irregular fibers do not cling or hold together as do cottons with longer, more regular, or stronger fibers, the break of different cottons should never be relied upon as an accurate indication of fiber length. Classers may make the pull in individual ways or by imitation of methods used by others. If the classer's method of stapling is faulty, the results obtained will of necessity be faulty. It is therefore important that the recommended method be learned and carefully followed.

83. **Special conditions in stapling.**—Some special characteristics of cotton are associated with methods of harvesting. They need to be noted in connection with stapling. Special precautions should be observed in classing snapped, sledded, and bolly cotton, cotton of perished staple, and cotton of immature staple. If snapped or sledded cotton is entirely sound and regular in staple, no reduction is made in the staple-length designation because of the method of harvesting. If it is irregular, weak, wasty, immature, or perished, then the length from which and the length to which the reduction is made, as well as the condition on account of which the reduction is made, should be stated. Bolly cotton, by its very nature, is generally immature and should be carefully examined for this condition.

84. **Perished staple.**—Cotton that has had strength of fiber, as ordinarily found in cotton, destroyed or unduly reduced through exposure to the weather, either before picking or after baling, or through heating by fire, or on account of water packing, or by other causes, is called perished staple. This definition includes not only weakening and deterioration of staple because of exposure of the cotton in the seed, but also because of country damage, ship damage, and fire damage. If such a condition exists, it must be noted when the classification is made.

85. **Immature cotton.**—Cotton that has been picked and baled before the fiber has reached a normal state of maturity, resulting in a weakened staple of inferior value, is known as cotton of immature staple. Snapped, sledded, and bolly cotton should be scrutinized for immature staple. If immature staple is present, it must be noted when the classification is made.

J. COMMON ERRORS IN STAPLING

86. **Lack of familiarity with standards an outstanding cause of error.**—Errors or variations in stapling cotton are due principally to lack of familiarity with or understanding of the official staple types. A classer should be thoroughly familiar with the staple types and with any private types against which he works. He can thus help to avoid erratic classing, as well as the tendency to class too hard or too easy. It is particularly important that before each day's work begins the classer pull the types representing the range of lengths to be classed during the day. Thus he should be able each morning accurately to adjust his perceptions of lengths to the types and thereby avoid temporary departures from them in his classing work.

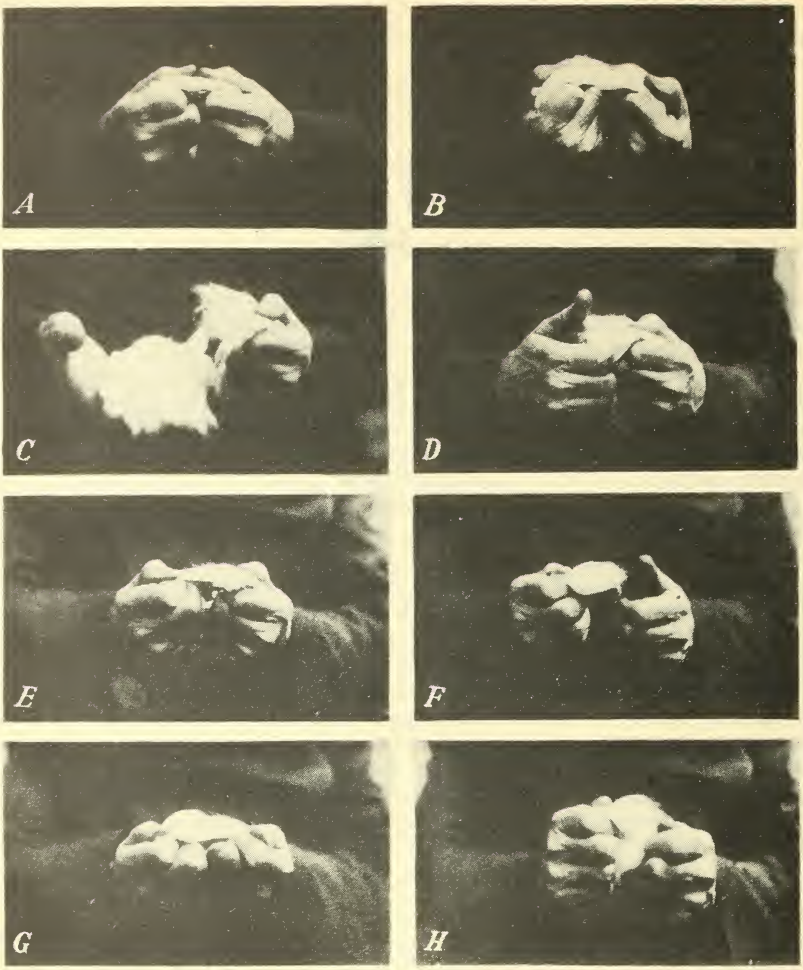


FIGURE 17.—Method of pulling staple. (See text for instructions.)

87. **Tendency to omit certain lengths.**—One tendency that is somewhat general is that of classifying cottons in sixteenths of an inch, ignoring, more or less, the odd thirty-seconds. Such a tendency should be avoided by frequent reference to the staple types and by the analysis of classification results.

88. **Tendency to class all staples toward familiar lengths.**—Another cause of trouble in classification is the tendency to class all staple toward the lengths with which the classer is most familiar. It is because these inaccuracies arise so subtly that attention must be called to them. If a classer is unaware of the bias that he may so easily acquire by having to class a particular kind or length of cotton to the exclusion of other kinds or lengths, he will fail to realize the need for keeping his judgment on other staples up to standard by constant practice in judging against the standards. The correction is very simple if only he is aware of the need for it.

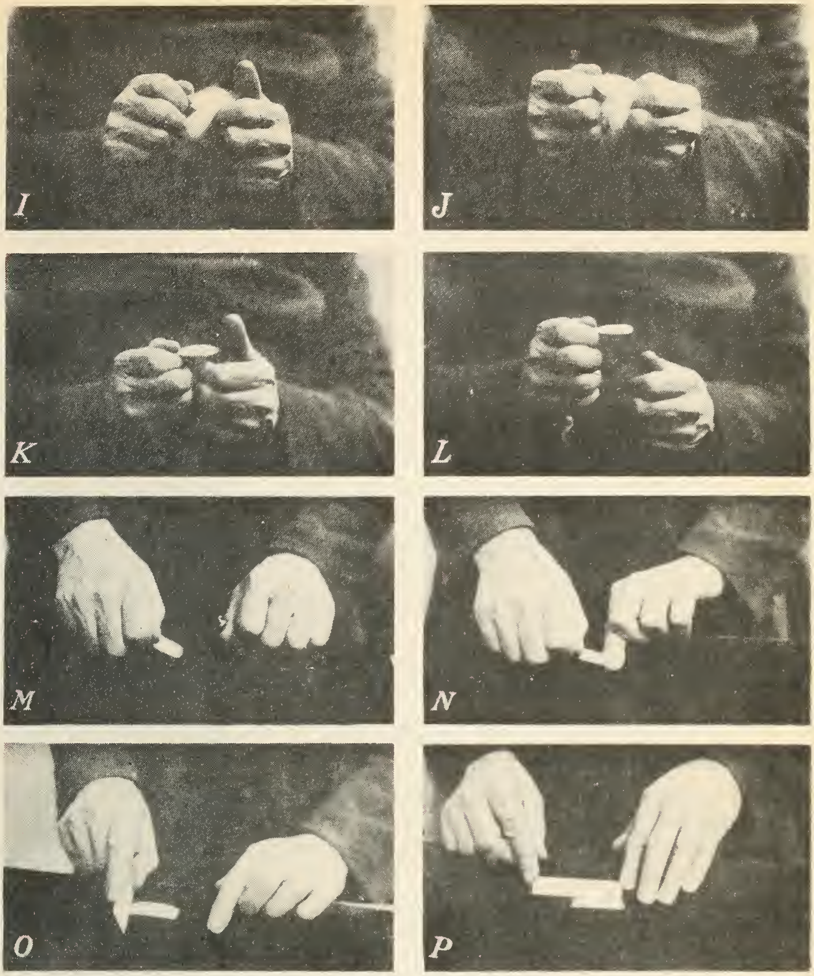


FIGURE 17.—*Continued.*—Method of pulling staples.

89. **Judging on the break.**—As already indicated, some classers become accustomed to judging staple length in part by the break of the cotton (particularly for the shorter lengths), that is, on the feel of the cotton as the fibers are pulled out or separated from each other in a quick break of a sample. When rapid stapling is necessary, a classer may break a sample and call the staple without completing the pull. Such a procedure should always be avoided.

90. **Other causes of error.**—Among the other causes of errors in stapling are, as heretofore stated: Failure to condition samples properly; classing in a poor light under which it is difficult to make correct judgments; rapid stapling, in which due consideration is not given to irregularities and defects; and failure to examine carefully both sides of the sample for mixed staple.

K. FACTORS OF CHARACTER

91. **General definition of character.**—Character may be defined as those elements of cotton quality which are not included in grade or staple length. At present there are no character standards, nor is there entire agreement as to all the quality elements that should be included in character.

92. **Purpose of character appraisal.**—The ultimate purpose of character classification is to give an appraisal of different cottons for marketing and manufacturing purposes. Cottons of a given grade and staple produce satisfactory yarn in some cases and an unsatisfactory yarn in others. The reason for the difference is usually ascribed to character. Through experience, classers and millmen become familiar with the characteristics of cotton that will and will not give good spinning results for their particular purposes. Good cottons are usually spoken of as "hard-bodied" or "strong" cottons, and poor cottons are usually referred to as "soft," "weak," "irregular," "weak and wasty," or "perished." A classer's conception of cotton that meets these designations is sometimes influenced by his previous experience in selecting cotton for a particular utilization. However, in spite of the skill that a classer or mill superintendent may have developed in differentiating between desirable and undesirable characters for his own purposes, classing for character, when put to the practical test of manufacture, is often disappointing. For example, one millman of long experience said:

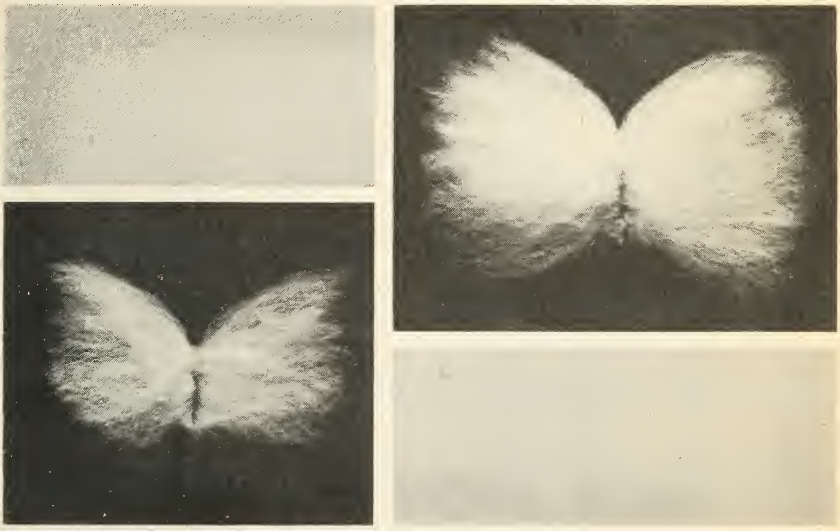
> We should always hesitate to report on the matter of uniformity, fiber body, or strength. We question if this can be done with any degree of precision in the absence of any specific method or standard which can be used as a basis. Generally in cottons we have our preference under the category of character, but in our opinion such preference is only an impression, and in our experience ofttimes not substantiated in manufacturing.

93. **Character not officially standardized.**—A number of factors are recognized as a part of character. Some are measurable at the present time, others are not; and no satisfactory method of integrating them into a measured whole, or even into a describable whole, has yet been developed. These factors include the wall thickness of the fibers, and their fineness, strength, uniformity, spirality, pliability, and cohesiveness. There is always the tendency on the part of a cotton classer to adjust grade and staple designations by impressions received from character factors, in order to give what the trade considers a more accurate quality classification of the cotton, but it is evident that such a procedure may cause considerable confusion.

94. **Laboratory methods for measuring some character factors.**—Uniformity, strength, fiber fineness, and wall thickness are factors susceptible of measurement, and laboratory investigations are being made of these several factors. Elasticity, pliability, and frictional properties cannot yet be measured adequately; fiber porosity and fiber durability are not yet sufficiently understood to permit measurement.

95. **Uniformity of length.**—Uniformity of staple length, a measurable factor, is important because it is closely related to spinning behavior and utility. In reality it is a property of length, but by general usage it is considered an element of character. The classer recognizes irregular cotton when, in pulling the staple, he has difficulty in obtaining a definite, smooth, rectangular tuft of cotton, and when, in pulling out the longer fibers and discarding them, he never comes to any very

definite length. A uniform cotton, on the other hand, may be readily pulled to its staple length. Uniformity is important because (1) it contributes to uniformity in the size and strength of yarns, (2) cottons of greater uniformity usually contain less waste than cotton of less uniformity, and (3) the more uniform cottons can be manufactured more easily and with less expense than the less uniform cottons. Figure 18 illustrates the lengths of fiber on seeds that will produce irregular lint compared with those that will produce uniform lint.



BPI 14059

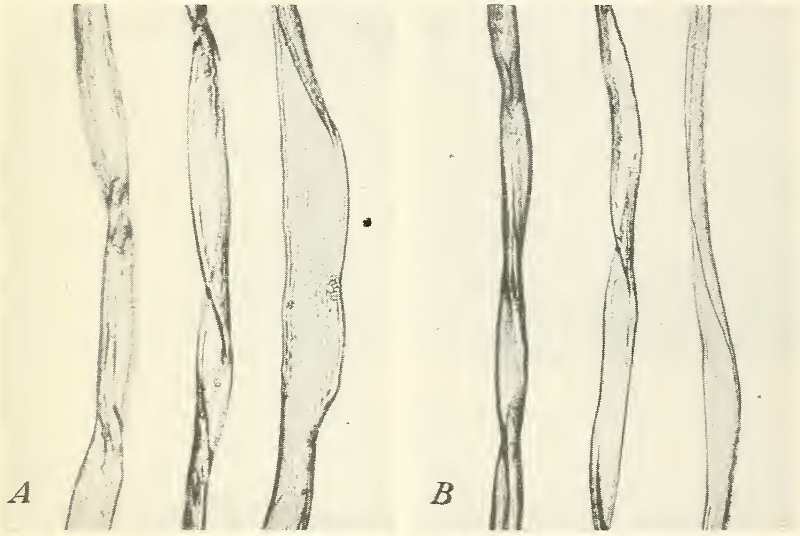
FIGURE 18.—Uniformity of length. These illustrations show two cottonseeds the lint of which has been combed out to demonstrate uniformity. The specimen at the right is from a pure strain selected for its regularity. Observe the contrast in the specimen on the left which has degenerated into a "butterfly" type. The longer fibers at the top of such seeds when ginned with the shorter fibers on the pedicel end of the seed will produce a lint lacking in uniformity.

96. **Strength of fiber.**—Strength, another measurable character factor, is also important. Although it depends largely on variety and growth conditions, it may be affected by ginning practices that injure the fibers and by weather exposure, excess moisture, and bacteriological and other organic action which causes them to deteriorate. Studies indicate that strength is somewhat related to length, but that the relationship is not always close. Cotton fibers differ greatly in strength, and although experiments show that raw cotton of greater average strength usually gives yarn of greater average strength, the strength of individual fibers is not always related to the strength of yarn. This is because there must be more fibers in a cross section of yarn made from fine fibers than in one of yarn made from coarse fibers.

97. **Strength as determined by the classer.**—The classer ordinarily determines strength by pulling out some of the fibers and breaking them in his fingers. A strong-fibered cotton is one that has more than the usual strength; a normal-fibered cotton is one in which the strength seems to be normal or average; a cotton of fair strength is below average; a weak-fibered cotton has very poor strength; and perished cotton is that in which the strength has been so greatly reduced that it is almost lacking. The classer's impressions of strength

may not depend so much upon the actual strength of the fibers as upon their fineness and drag. Fine fibers may give an impression of weakness, as they ordinarily slip through the fingers more readily and do not give as much resistance as the usual run of cotton.

98. **Fineness and maturity of fibers.**—Two other elements of character for which laboratory tests are available are fiber fineness and fiber maturity. Laboratory tests for fineness may consist of the measurement of either weight fineness or geometrical fineness, the former being in terms of weight per unit length of the fiber and the latter in terms of some linear dimension of the cross section of the fiber. The measure of maturity helps to explain the fineness or coarseness by giving information about the thickness of the fiber wall (fig. 19). Figure 20 gives an idea of the wide range in geometrical fineness and in wall thickness of fibers of selected cottons.



BAE 26670

FIGURE 19.—Range of wall thickness in coarse (*A*) and fine (*B*) fibers. (× about 237.)

L. EFFECT OF MOISTURE ON STAPLE AND CHARACTER

99. **Physical properties affected by moisture content**—Various properties of cotton are affected by moisture.[5] These properties—pliability, drag, elasticity, strength, and length—affect each other, and together they undoubtedly influence the classer in the process of stapling. Several of these are character factors, but since moisture also affects the stapling process through its effect upon these several factors, they are discussed in a separate section.

100. **Pliability.**—A thing is pliable if it is easily bent; that is to say, if it is flexible or limber. In spite of their apparent limberness or flexibility, cotton fibers have a certain degree of rigidity. They appear to be very soft and flexible only because of the extreme smallness of the filaments. The actual pliability changes as the moisture content

---

[5] The term "moisture content" is sometimes used in referring to the amount of water in cotton. It differs from "regain" only in the base on which it is figured. Regain is figured on a bone-dry weight-whereas moisture content is figured on the original weight, which includes the moisture.

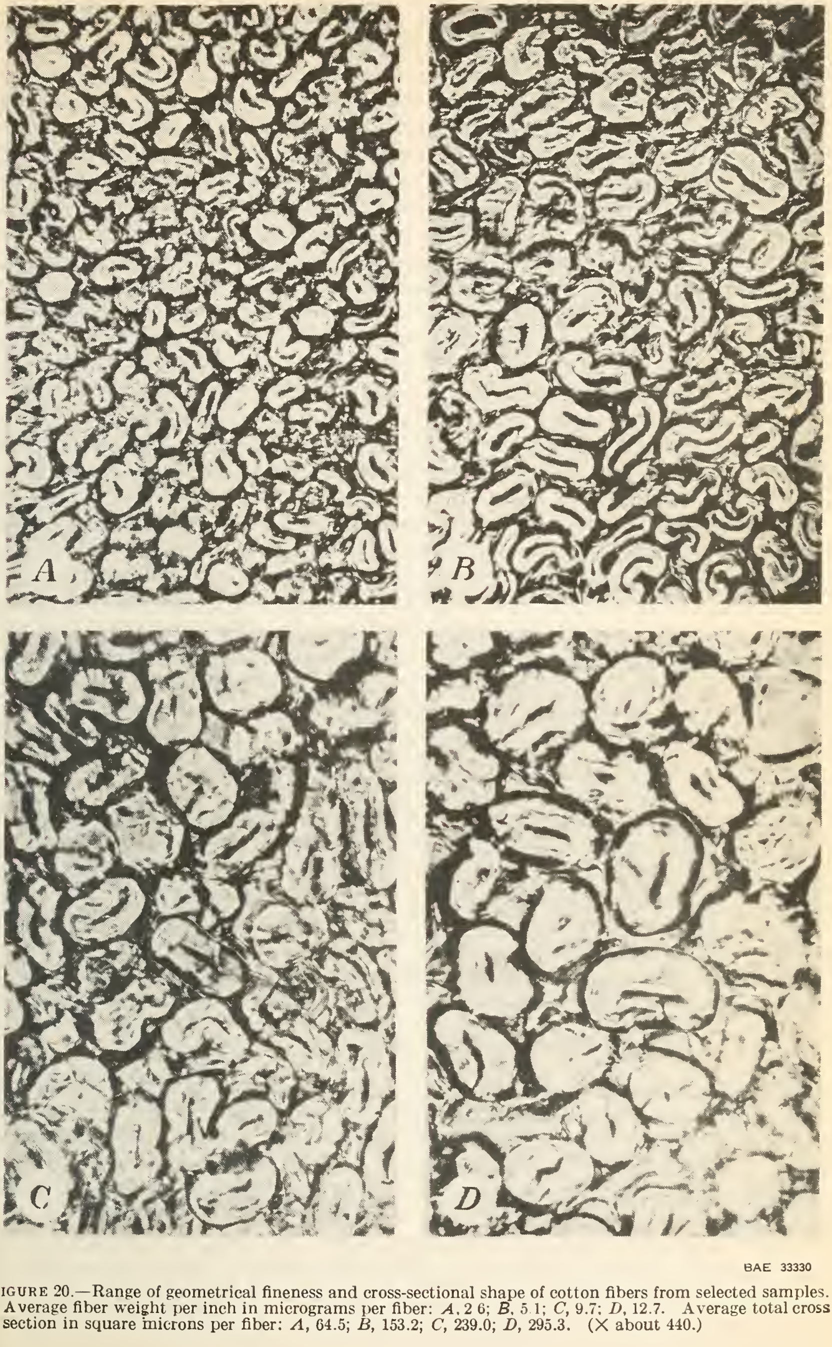


FIGURE 20.—Range of geometrical fineness and cross-sectional shape of cotton fibers from selected samples. Average fiber weight per inch in micrograms per fiber: *A*, 2.6; *B*, 5.1; *C*, 9.7; *D*, 12.7. Average total cross section in square microns per fiber: *A*, 64.5; *B*, 153.2; *C*, 239.0; *D*, 295.3. (× about 440.)

of the fiber changes, and this property often influences the cotton classer in making staple judgments.

If a handful of ginned lint is examined closely, it will be observed that the fibers are greatly entangled, a fact which is evident each time a classer breaks a sample in the process of stapling. The individual fibers are wavy, and the waviness is a partial cause of the resistance which the classer notices in breaking a sample. Furthermore, this resistance is influenced by the limberness of the fibers, or the ease with which the individual waves straighten out and allow the fibers to slide past each other. Thus there is a chain of events depending on the relative humidity of the atmosphere, which causes differences in breaking resistance, or drag. Drag undoubtedly depends upon the number and regularity of fiber convolutions as well as the waviness of the fibers and their tangled condition. The convolutions, in contrast to waviness, are small twists of the fiber that are almost invisible to the naked eye. The number of these convolutions per inch decreases as the moisture content of the fiber increases. The change can be demonstrated by suspending a small match stem by a single cotton hair (attached to the middle of the stem) over a tumbler of water, leaving the match stem free to rotate as it is raised and lowered above the water.

101. **Elasticity.**—Elasticity is another property that affects judgment of staple because of differences in moisture content. When a single cotton fiber is stretched, the first effect is to remove its waviness. As elongation is continued the fiber becomes taut, the convolutions begin to unwind, and the whole cell is actually stretched. If the fiber is released unbroken it will tend to return to its original configuration. The degree of return is somewhat dependent upon the moisture content, since the resistance offered to elongation, the amount of elongation before breaking, and the rapidity of return to its original condition change as the relative humidity of the atmosphere affects the moisture content of the cotton.

102. **Strength.**—The strength of fiber is also influenced by moisture content, increasing considerably as the humidity of the atmosphere in contact with the fibers is increased from about 15 to 60 percent. Above this, the humidity has little effect.

103. **Frictional properties.**—Again, in consequence of its effect upon pliability, elasticity, and drag, the amount of moisture affects the frictional properties of the fibers so that the classer may arrive at different lengths for the same sample under different conditions.

M. RELATION OF CLASSIFICATION TO PRICES

104. **Classification and price.**—When the term "value" is used in cotton marketing, it usually refers to the price of cotton. The value of cotton of a given quality is indicated by the price at which it sells. When such other factors as time and place of purchase and market conditions are equal, higher qualities of cotton are generally more valuable than lower qualities.

105. **Futures contracts.**—In transactions in futures contracts made on the American cotton futures exchanges, for which the basis grade is always Middling, settlements for grades other than Middling are made by the use of commercial differences. These differences are determined by a price quotations committee located in each cotton market designated by the Secretary of Agriculture for this purpose.

At this time (1938) there are 10 such markets—Norfolk, Va.; Augusta, Ga.; Savannah, Ga.; Montgomery, Ala.; New Orleans, La.; Memphis, Tenn.; Little Rock, Ark.; Dallas, Tex.; Houston, Tex.; and Galveston, Tex. The committees make up daily their quotations for Middling as well as for grades other than Middling, based on actual sales of spot cotton, bids and offers, and other available information. The average of the quotations of the 10 markets serves for settlements of futures contracts on which grades of cotton other than Middling are delivered. Quotations in the 10 markets cover 32 grades, of which 20 are deliverable in settlement of futures contracts, including the basis grade of Middling.

106. **Grade differences.**—No cotton is delivered on futures contracts without taking both grade and staple into consideration. Mill purchases of spot cotton are usually made for specific qualities. In spot transactions involving grades other than Middling, the basis grade customarily is Middling, with differences—"ons" (premiums) and "offs" (discounts)—for grades above and below Middling. Cotton of grades higher than Middling commands premiums, and cotton of grades lower than Middling sells at discounts. Differences may be stated in cents or in fractions of a cent per pound, usually expressed in points or hundredths of a cent. For example, assuming the price of Middling to be 10 cents and the difference "on" for Strict Middling to be 32 points, the price for Strict Middling would be 10.32 cents per pound. Should the difference "off" for Strict Low Middling be 38 points, the price for Strict Low Middling would be 9.62 cents (table 5). In transactions for spot cotton in which grades other than Middling are involved and in which Middling is the basis grade, the buyer and the seller stipulate in their contract that settlement for grades other than Middling shall be based on a set of differences agreed upon between them.

TABLE 5.—*Examples of grade differences*

Grade of white standards	Norfolk	Augusta	Savannah	Montgomery	New Orleans	Memphis	Little Rock	Dallas	Houston	Galveston	Average
No. 4 or Strict Middling	On 25	On 25	On 25	On 25	On 25	On 25	On 25	On 25	On 25	On 25	On 25
No. 5 or Middling (basis grade)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
No. 6 or Strict Low Middling	Off 35	Off 38	Off 35	Off 35	Off 30	Off 40	Off 40	Off 45	Off 40	Off 40	Off 38

107. **Staple premiums and discounts.**—Cotton longer than seven-eighths inch in staple usually commands a premium and cotton shorter than seven-eighths inch sells at a discount. The quotations committees of the designated markets referred to in paragraph 105 issue quotations for the lengths thirteen-sixteenths, fifteen-sixteenths, and 1 inch, based on seven-eighths inch for the various grades of upland cotton, though thirteen-sixteenths-inch cotton is not deliverable on futures contracts. Available data indicate that for the grades Low Middling White up to Middling Fair, inclusive, premiums for staple increase materially for every one-thirty-second of an inch, but that staple premiums for cotton of the grades below Low Middling White and for the colored cottons increase but little for the lengths longer than seven-eighths inch. Discounts for staple shorter than seven-eighths inch, according to available information, vary considerably from season to season, as do the premiums for the lengths longer than seven-eighths inch.

LITERATURE CITED

(1) Agelasto, A. M., Doyle, C. B., Meloy, G. S., and Stine, O. C.
1922. the cotton situation. U. S. Dept. Agr. Yearbook 1921: 323–406, illus.

(2) Nickerson, Dorothy.
1929. a method for determining the color of agricultural products. U. S. Dept. Agr. Tech. Bull. 154, 32 pp., illus.

(3) Pearson, Norma L.
1933. neps and similar imperfections in cotton. U. S. Dept. Agr. Tech. Bull. 396, 19 pp., illus.

(4) United States Bureau of Agricultural Economics.
1925. official standards of the united states for american cotton linters. U. S. Bur. Agr. Econ. Serv. and Regulat. Announc. 94, 9 pp.

(5) ———
1929. proceedings of international universal cotton standards conference of 1929 and items relating to the administration of the united states cotton futures and cotton standards acts. U. S. Bur. Agr. Econ. Serv. and Regulat. Announc. 117, 23 pp.

(6) ———
1934. items relating to the administration of the united states cotton standards and cotton futures acts. U. S. Bur. Agr. Econ. Serv. and Regulat. Announc. 146, 21 pp.

(7) ———
1936. regulations of the secretary of agriculture under the united states cotton futures act. U. S. Bur. Agr. Econ. Serv. and Regulat. Announc. 152, 22 pp.

(8) ———
1936. regulations of the secretary of agriculture under the united states cotton standards act. U. S. Bur. Agr. Econ. Serv. and Regulat. Announc. 153, 26 pp.

APPENDIX

OFFICIAL COTTON STANDARDS OF THE UNITED STATES IN EFFECT MAY 1938

Those indicated by an asterisk (*) are descriptive standards. They are fixed by the physical standards for adjacent grades and staple lengths]

FOR GRADES AND COLORS OF AMERICAN UPLAND COTTON

*No. 1 or Middling Fair.
No. 2 or Strict Good Middling.
No. 3 or Good Middling.
No. 4 or Strict Middling.
No. 5 or Middling.
No. 6 or Strict Low Middling.
No. 7 or Low Middling.
No. 8 or Strict Good Ordinary.
No. 9 or Good Ordinary.
No. 3 Tinged, or Good Middling Tinged.
No. 4 Tinged, or Strict Middling Tinged.
No. 5 Tinged, or Middling Tinged.
No. 6 Tinged, or Strict Low Middling Tinged.
No. 7 Tinged, or Low Middling Tinged.
*No. 3 Yellow Stained, or Good Middling Yellow Stained.
*No. 4 Yellow Stained, or Strict Middling Yellow Stained.
*No. 5 Yellow Stained, or Middling Yellow Stained.
*No. 3 Spotted, or Good Middling Spotted.
*No. 4 Spotted, or Strict Middling Spotted.
*No. 5 Spotted, or Middling Spotted.
*No. 6 Spotted, or Strict Low Middling Spotted.
*No. 7 Spotted, or Low Middling Spotted.
*No. 3 Gray, or Good Middling Gray.
*No. 4 Gray, or Strict Middling Gray.

*No. 5 Gray, or Middling Gray.
*No. 3 Extra White, or Good Middling Extra White.
*No. 4 Extra White, or Strict Middling Extra White.
*No. 5 Extra White, or Middling Extra White.
*No. 6 Extra White, or Strict Low Middling Extra White.
*No. 7 Extra White, or Low Middling Extra White.
*No. 8 Extra White, or Strict Good Ordinary Extra White.
*No. 9 Extra White, or Good Ordinary Extra White.

LENGTH OF STAPLE

Inches
*Below ¾
¾
13/16
⅞
29/32
15/16
31/32
1
1 1/32
1 1/16
1 3/32
1⅛
1 5/32
1 3/16
1 7/32
1¼
1 9/32
1 5/16
1 11/32
1⅜
*1 13/32
*1 7/16
*1 15/32
1½ (Types for both American upland and American-Egyptian.)
*1 17/32
1 9/16 (Types for American-Egyptian only.)
*1 19/32
1⅝ (Types for American-Egyptian only.)
*1 21/32
*1 11/16
*1 23/32
1¾ (Types for American-Egyptian only.)
and upward in steps of 1/32 inch. (No types above 1¾ inches.)

AMERICAN-EGYPTIAN COTTON

Grade No. 1.
*Grade No. 1½.
Grade No. 2.
*Grade No. 2½.
Grade No. 3.
*Grade No. 3½.
Grade No. 4.
*Grade No. 4½.
Grade No. 5.
*Below grade No. 5.

TENTATIVE STANDARDS FOR PREPARATION OF LONG-STAPLE COTTON

A preparation, No. 4 or Strict Middling.
B preparation, No. 4 or Strict Middling.
C preparation, No. 4 or Strict Middling.
A preparation, No. 5 or Middling.
B preparation, No. 5 or Middling.
C preparation, No. 5 or Middling.
A preparation, No. 6 or Strict Low Middling.
B preparation, No. 6 or Strict Low Middling.
C preparation, No. 6 or Strict Low Middling.

AMERICAN COTTON LINTERS

There are also in effect under the Cotton Standards Act official standards for American cotton linters, designated as grades 1 to 7, inclusive, and for linters that are below grade 7 and that carry the descriptive designation "hull fiber." (*4*).

Official standards for grades of sea-island cotton were promulgated in 1918 but were discontinued in 1925 because of the gradual failure of the sea-island crop. The growth of sea-island cotton is now being revived in Florida and Georgia, where the estimated total production for 1937 is somewhat in excess of 4,000 bales.

PUBLIC NOTICE ESTABLISHING OFFICIAL COTTON STANDARDS OF THE UNITED STATES FOR THE GRADE OF AMERICAN UPLAND COTTON, EFFECTIVE AUGUST 20, 1936

Pursuant to the authority vested in the Secretary of Agriculture by the United States Cotton Futures Act of August 11, 1916, as amended March 4, 1919 (U. S. C., title 26, sec. 731–752); May 31, 1920 (41 Stat. 725); and February 26, 1927 (U. S. C., sup. IV, title 26, sec. 736); and by section 6 of the United States Cotton Standards Act of March 4, 1923 (U. S. C., title 7, sec. 51–65), I, H. A. Wallace, Secretary of Agriculture, do hereby establish, promulgate, and give public notice of standards for grades of American upland cotton, as hereinafter set forth, effective August 20, 1936: *Provided*, That trading in futures contracts based upon standards now in effect may continue to the end of the last month which may be traded in at the time of this order, subject to settlement by the delivery of cotton according to such standards.

Since these standards have been agreed upon and accepted by the leading European cotton associations and exchanges, they may be also termed and referred to as universal standards for American cotton.

For the purposes of these standards:

WHITE COTTON

No. 1 (or Middling Fair).—No. 1 or Middling Fair shall be American upland cotton which in color, leaf, and preparation is better than No. 2 or Strict Good Middling.

No. 2 (or Strict Good Middling).—No. 2 or Strict Good Middling shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 2 or Strict Good Middling, effective August 20, 1936."

No. 3 (or Good Middling).—No. 3 or Good Middling shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 3 or Good Middling, effective August 20, 1936."

No. 4 (or Strict Middling).—No. 4 or Strict Middling shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 4 or Strict Middling, effective August 20, 1936."

No. 5 (or Middling).—No. 5 or Middling shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 5 or Middling, effective August 20, 1936."

No. 6 (or Strict Low Middling).—No. 6 or Strict Low Middling shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 6 or Strict Low Middling, effective August 20, 1936."

No. 7 (or Low Middling).—No. 7 or Low Middling shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 7 or Low Middling, effective August 20, 1936."

No. 8 (or Strict Good Ordinary).—No. 8 or Strict Good Ordinary shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 8 or Strict Good Ordinary, effective August 20, 1936."

No. 9 (or Good Ordinary).—No. 9 or Good Ordinary shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 9 or Good Ordinary, effective August 20, 1936."

EXTRA WHITE COTTON

No. 3 Extra White (or Good Middling Extra White).—No. 3 Extra White or Good Middling Extra White shall be American upland cotton which in leaf and preparation is No. 3 or Good Middling, but which is whiter than No. 3 or Good Middling.

No. 4 Extra White (*or Strict Middling Extra White*).—No. 4 Extra White or Strict Middling Extra White shall be American upland cotton which in leaf and preparation is No. 4 or Strict Middling, but which is whiter than No. 4 or Strict Middling.

No. 5 Extra White (*or Middling Extra White*).—No. 5 Extra White or Middling Extra White shall be American upland cotton which in leaf and preparation is No. 5 or Middling, but which is whiter than No. 5 or Middling.

No. 6 Extra White (*or Strict Low Middling Extra White*).—No. 6 Extra White or Strict Low Middling Extra White shall be American upland cotton which in leaf and preparation is No. 6 or Strict Low Middling, but which is whiter than No. 6 or Strict Low Middling.

No. 7 Extra White (*or Low Middling Extra White*).—No. 7 Extra White or Low Middling Extra White shall be American upland cotton which in leaf and preparation is No. 7 or Low Middling, but which is whiter than No. 7 or Low Middling.

No. 8 Extra White (*or Strict Good Ordinary Extra White*).—No. 8 Extra White or Strict Good Ordinary Extra White shall be American upland cotton which in leaf and preparation is No. 8 or Strict Good Ordinary, but which is whiter than No. 8 or Strict Good Ordinary.

No. 9 Extra White (*or Good Ordinary Extra White*).—No. 9 Extra White or Good Ordinary Extra White shall be American upland cotton which in leaf and preparation is No. 9 or Good Ordinary, but which is whiter than No. 9 or Good Ordinary.

TINGED COTTON

No. 3 Tinged (*or Good Middling Tinged*).—No. 3 Tinged or Good Middling Tinged shall be American upland cotton which in leaf and preparation is No. 3 or Good Middling, but which in color is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 3 Tinged or Good Middling Tinged, effective August 20, 1936."

No. 4 Tinged (*or Strict Middling Tinged*).—No. 4 Tinged or Strict Middling Tinged shall be American upland cotton which in leaf and preparation is No. 4 or Strict Middling, but which in color is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 4 Tinged or Strict Middling Tinged, effective August 20, 1936."

No. 5 Tinged (*or Middling Tinged*).—No. 5 Tinged or Middling Tinged shall be American upland cotton which in leaf and preparation is No. 5 or Middling, but which in color is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the district of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 5 Tinged or Middling Tinged, effective August 20, 1936."

No. 6 Tinged (*or Strict Low Middling Tinged*).—No. 6 Tinged or Strict Low Middling Tinged shall be American upland cotton which in leaf and preparation is No. 6 or Strict Low Middling, but which in color is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 6 Tinged or Strict Low Middling Tinged, effective August 20, 1936."

No. 7 Tinged (*or Low Middling Tinged*).—No. 7 Tinged or Low Middling Tinged shall be American upland cotton which in leaf and preparation is No. 7 or Low Middling, but which in color is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original official cotton standards of the United States, American upland, No. 7 Tinged or Low Middling Tinged, effective August 20, 1936."

SPOTTED COTTON

No. 3 Spotted (*or Good Middling Spotted*).—No. 3 Spotted or Good Middling Spotted shall be American upland cotton which in leaf and preparation is No. 3 or Good Middling, but which in color is between No. 3 or Good Middling and No. 3 Tinged or Good Middling Tinged.

No. 4 Spotted (*or Strict Middling Spotted*).—No. 4 Spotted or Strict Middling Spotted shall be American upland cotton which in leaf and preparation is No. 4 or Strict Middling, but which in color is between No. 4 or Strict Middling and No. 4 Tinged or Strict Middling Tinged.

No. 5 Spotted (*or Middling Spotted*).—No. 5 Spotted or Middling Spotted shall be American upland cotton which in leaf and preparation is No. 5 or Middling, but which in color is between No. 5 or Middling and No. 5 Tinged or Middling Tinged.

No. 6 Spotted (*or Strict Low Middling Spotted*).—No. 6 Spotted or Strict Low Middling Spotted shall be American upland cotton which in leaf and preparation is No. 6 or Strict Low Middling, but which in color is between No. 6 or Strict Low Middling and No. 6 Tinged or Strict Low Middling Tinged.

No. 7 Spotted (*or Low Middling Spotted*).—No. 7 Spotted or Low Middling Spotted shall be American upland cotton which in leaf and preparation is No. 7 or Low Middling, but which in color is between No. 7 or Low Middling and No. 7 Tinged or Low Middling Tinged.

YELLOW STAINED COTTON

No. 3 Yellow Stained (*or Good Middling Yellow Stained*).—No. 3 Yellow Stained or Good Middling Yellow Stained shall be American upland cotton which in leaf and preparation is No. 3 or Good Middling, but which in color is deeper than No. 3 Tinged or Good Middling Tinged.

No. 4 Yellow Stained (*or Strict Middling Yellow Stained*).—No. 4 Yellow Stained or Strict Middling Yellow Stained shall be American upland cotton which in leaf and preparation is No. 4 or Strict Middling, but which in color is deeper than No. 4 Tinged or Strict Middling Tinged.

No. 5 Yellow Stained (*or Middling Yellow Stained*).—No. 5 Yellow Stained or Middling Yellow Stained shall be American upland cotton which in leaf and preparation is No. 5 or Middling, but which in color is deeper than No. 5 Tinged or Middling Tinged.

GRAY COTTON

No. 3 Gray (*or Good Middling Gray*).—No. 3 Gray or Good Middling Gray shall be American upland cotton which in leaf and preparation is No. 3 or Good Middling, but which is more gray in color than No. 3 or Good Middling and no darker in color than the dullest bale in No. 6 or Strict Low Middling.

No. 4 Gray (*or Strict Middling Gray*).—No. 4 Gray or Strict Middling Gray shall be American upland cotton which in leaf and preparation is No. 4 or Strict Middling, but which is more gray in color than No. 4 or Strict Middling and no darker in color than the dullest bale in No. 7 or Low Middling.

No. 5 Gray (*or Middling Gray*).—No. 5 Gray or Middling Gray shall be American upland cotton which in leaf and preparation is No. 5 or Middling, but which is more gray in color than No. 5 or Middling and no darker in color than the dullest bale in No. 8 or Strict Good Ordinary.

GENERAL

American upland cotton which in color, leaf, and preparation is within the range of the standards established by this notice, but which contains a combination of color, leaf, and preparation not within any one of the definitions herein set out, shall be designated according to the definition which is equivalent to, or if there be no exact equivalent is next below, the average of all the factors that determine the grade of the cotton: *Provided*, That in no event shall the grade assigned to any cotton or sample be more than one grade higher than the grade classification of the color or leaf contained therein.

Effective as specified in the first paragraph hereof, this notice shall supersede the public notice of July 30, 1923, establishing official cotton standards of the United States for grades and colors of American upland cotton and the public notice of the Secretary of Agriculture dated August 10, 1932, establishing official cotton standards of the United States for Extra White cotton.

In testimony whereof I have hereunto set my hand and caused the official seal of the Department of Agriculture to be affixed, in the City of Washington, this 20th day of August 1935.

H A Wallace

Secretary of Agriculture.

PUBLIC NOTICE ESTABLISHING STANDARDS FOR LENGTH OF STAPLE

DEPARTMENT OF AGRICULTURE,
Washington.

Pursuant to the authority vested in the Secretary of Agriculture by section 9 of the United States cotton futures act approved August 11, 1916, 39 United States Statutes at Large, page 476, I, David F. Houston, Secretary of Agriculture, do hereby establish, promulgate, and give public notice of, standards for length of staple of cotton, effective October 25, 1918, as follows:

OFFICIAL COTTON STANDARDS OF THE UNITED STATES FOR LENGTH OF STAPLE

For the purposes of these standards:

SECTION 1. The length of staple of any cotton shall be the normal length by measurement, without regard to quality or value, of a typical portion of its fibers under a relative humidity of the atmosphere of 65 percent and a temperature of 70° F.

SEC. 2. The length of staple of any cotton shall be designated by that one of the following terms which expresses its measurement in inches or fractions of an inch in accordance with section 1 of this order:

Below 3/4; 3/4; 13/16; 7/8; 15/16; 1; 1 1/32; 1 1/16; 1 3/32; 1 1/8; 1 5/32; 1 3/16; 1 7/32; 1 1/4; 1 9/32; 1 5/16; 1 11/32; 1 3/8; 1 13/32; 1 7/16; 1 15/32; 1 1/2; 1 17/32; 1 9/16; 1 19/32; 1 5/8; 1 21/32; 1 11/16; 1 23/32; 1 3/4; and upward in like manner in gradations of thirty-seconds, disregarding any fraction less than a thirty-second.

SEC. 3. The lengths of staple designated as 3/4, 7/8, 1, 1 1/16, 1 1/8, 1 3/16, 1 1/4, 1 5/16, 1 3/8, 1 1/2, 1 5/8, and 1 3/4 inches, respectively, are each represented by a sample in the custody of the United States Department of Agriculture in a container marked "Original official cotton standards of the United States, length of staple" followed by the appropriate designation of such length of staple.

SEC. 4. Cotton which is more than three-fourths of an inch in length of staple, but is not exactly one of the measurements specified in section 2 of this order, shall be designated by that one of such measurements which comes nearest under its true measurement.

SEC. 5. Whenever the length of staple of cotton taken from one part of a bale is different from that taken from another part of the same bale, the length of staple of the cotton in such bale shall be that of the part which is the shorter.

In testimony whereof, I have hereunto set my hand and caused the official seal of the Department of Agriculture to be affixed, in the District of Columbia, this 25th day of October 1918.

[SEAL]

D. F. HOUSTON,
Secretary.

NOTE.—Sections 2 and 3 of the foregoing order have been revised from time to time. As now in effect (May 1938) these two sections read as follows:

SEC. 2. The length of staple of any cotton shall be designated by that one of the following terms which expresses its measurement in inches or fractions of an inch in accordance with section 1 of this order:

Below 3/4; 3/4; 13/16; 7/8; 29/32; 15/16; 31/32; 1; 1 1/32; 1 1/16; 1 3/32; 1 1/8; 1 5/32; 1 3/16; 1 7/32; 1 1/4; 1 9/32; 1 5/16; 1 11/32; 1 3/8; 1 13/32; 1 7/16; 1 15/32; 1 1/2; 1 17/32; 1 9/16; 1 19/32; 1 5/8; 1 21/32; 1 11/16; 1 23/32; 1 3/4; and upward in like manner in gradations of thirty-seconds, disregarding any fraction less than a thirty-second.

SEC. 3. The lengths of staple designated as 3/4, 13/16, 7/8, 29/32, 15/16, 31/32, 1, 1 1/32, 1 1/16, 1 3/32, 1 1/8, 1 5/32, 1 3/16, 1 7/32, 1 1/4, 1 9/32, 1 5/16, 1 11/32, 1 3/8, 1 1/2 inches, respectively, are each represented by a quantity of American upland cotton suitably contained and marked "Original representation of official cotton standards of the United States (American upland), length of staple," followed in each instance by the appropriate designation of staple length and the effective date hereof; and the lengths of staple designated as 1 1/2, 1 9/16, 1 5/8, and 1 3/4 inches are each represented by a quantity of American-Egyptian cotton suitably contained, and marked "Original representation of official cotton standards of the United States (American-Egyptian), length of staple," followed in each instance by the appropriate designation of staple length and the effective date hereof, which said quantities of cotton are to be kept in the custody of the United States Department of Agriculture.

An entire bale of cotton is now the "original representation" for each length, and thus there is a sufficient quantity of each to permit reference to it, as need arises from time to time without risk of early depletion.

PROMULGATION OF GRADE STANDARDS FOR AMERICAN-EGYPTIAN COTTON AND OF TENTATIVE PREPARATION STANDARDS FOR LONG-STAPLE COTTON

The grade standards now in effect (May 1938) for American-Egyptian cotton were promulgated by the Secretary of Agriculture on April 10, 1929, effective August 1, 1930 (*5*); those for half grades of American-Egyptian cotton on July 3, 1930, effective July 3, 1931 (*6*); and the public notice concerning the tentative standards for the preparation of long-staple cotton was issued May 20, 1929 (*6*).

○

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
Price 10 cents